VISUAL AIDS

G. G. Weaver - E. W. Bollinger

VISUAL AIDS

Their Construction and Use

A display of teaching aids

VISUAL AIDS

Their Construction and Use

by

GILBERT G. WEAVER
Director of Training
New York State Education Department

AND

ELROY W. BOLLINGER
Professor, Industrial Teacher Training
New York State Education Department

THIRD PRINTING

D. VAN NOSTRAND COMPANY, INC.

TORONTO NEW YORK LONDON

NEW YORK

D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York 3

TORONTO

D. Van Nostrand Company (Canada), Ltd., 228 Bloor Street, Toronto

LONDON

Macmillan & Company, Ltd., St. Martin's Street, London, W.C. 2

Published simultaneously in Canada by
D. VAN NOSTRAND COMPANY (Canada), LTD.

First Published September 1949
Reprinted June 1950, July 1951

PRINTED IN THE UNITED STATES OF AMERICA

Preface

It is the purpose of this book to develop an appreciation of the value of visual aids and to encourage their use. The various techniques of making them are presented so that teachers can design and construct their own teaching aids when the need arises.

Too frequently, the terms *motion pictures* and *slide films* are thought to represent the entire scope of visual aids. This is a misconception. Every picture, chart, graph, model or other aid that appeals to the sense of vision may be classified as a visual aid.

This publication does not carry the whole story, but it does give a comprehensive view of the subject with an extensive group of illustrations. Although the examples of visual aids and their use are cited in the field of vocational education, the same ideas and techniques are applicable to all levels of education.

Teachers will use visual aids to the extent to which they realize their potency and are familiar with projection equipment. Therefore, this treatise is written with the idea that it will serve as a textbook in colleges and universities where visual aids courses are offered to members of the teaching profession. It will also serve as a handbook and reference book for persons in schools, clubs, industries and other organizations where visual aids are used for instruction, advertising and propaganda.

The authors wish to express their sincere appreciation for the co-operation and assistance extended to them by the various manufacturers of visual equipment. They are, furthermore, appreciative of the assistance secured through the Society for Visual Education, the magazines *See and Hear, Audio-Visual Guide, Educational Screen, Business Screen,* and *Architectural Record.* They appreciate, also, the courtesies extended by C. W. Dickinson, Jr., Director of School Libraries, State Board of Education, Virginia; G. E. Hamilton, Chairman, Keystone View Company; and Gerard Kelly, formerly of Sound Masters, Inc. We are furthermore indebted to Margaret Kehoe, our school registrar, for the personal sacrifices she made in connection with the editing of the original manuscript.

G. G. W.
E. W. B.

Contents

CHAPTER I

Visual Aids and the Sense of Vision

Vision and Its Part in Learning

When the term *visual aids* is mentioned, many people interpret it as synonymous with motion pictures. This situation is due, in all probability, to the extensive advertising of films, which, in turn, has made educators film conscious. A visual aid, however, is any specifically prepared drawing, illustration, model, motion picture, film strip, or other device that will expedite learning through the sense of vision. Although all these things are visual in character, a more descriptive and inclusive term for them is **teaching aids.** There is, nevertheless, a general tendency to call them visual aids; therefore, the terms will be used in this book interchangeably.

The use of visual aids in teaching is by no means a new idea or a modern technique. Aids of this type have been used throughout educational history but not by all teachers and not as often as desirable by the better teachers. The development and extensive use of motion pictures as a medium of entertainment have enhanced the value of visual learning, and, consequently, there has been a renewed and intensified interest in the use of visual instruction through the media of models, photographs, charts, exhibits, and projected pictures.

Educators were somewhat reluctant to accept motion pictures for educational purposes, but that hesitancy and skepticism seem to be on the wane. The motion picture has earned a place in educational programs on a par with that of the older forms of teaching aids. It is safe to predict that audio-visual aids have limitless possibilities and their use will be restricted only by the lack of resourcefulness on the part of the teachers who employ them.

The War Training Programs gave a timely impetus to the use of various interest-getting devices which cause concentration of atten-

tion and thereby accelerate learning. It has been claimed by some military leaders that 40 per cent of instructional time is saved by the use of visual methods. It is easy to appreciate this saving if we accept the statement of psychologists that 85 per cent of human knowledge is absorbed through the sense of sight. There are no scientific data to validate this figure, but it is reasonable to accept this percentage as approximately correct.

The results of the accelerated training courses given by the armed forces are challenging evidence in favor of visual aids and predict a great increase in the use of visual instruction. The learner will realize dividends in a saving of time and a greater understanding because "seeing is believing." Therefore, it seems logical to suggest that visual aids of various types be employed, whenever possible, because of their importance in the learning process. They are the stimulus for learning why, how, when, and where.

The Teacher's Problem

Although a teacher has numerous obligations to his students and a multiplicity of duties to perform, the prime purpose of his efforts is to aid the learner in the acquisition of knowledge as well as to direct his training toward the acquisition of skills. The teacher has learned through the study of psychology the correct approach to his teaching job. He has studied how people learn, when and how they react to varied stimuli, and what methods and devices should be used to evoke proper learning reaction. Despite this organized instruction many teachers still cling to verbal symbolism as their only medium of instruction. They continue to use ordinary language, metaphors, similes, and other figures of speech and thereby appeal to one sense only, that of hearing.

The teacher's problem is how to convey to students certain ideas, basic knowledge, and information in the shortest possible time and in accordance with the principles of learning. To accomplish this objective and to aid the learner in retaining the knowledge, teaching aids are practically indispensable. They *will not replace the teacher*, but they will make the teaching job easier and result in greater learning. George Bernard Shaw said, "The number of people who can read is small, the number of those who can read to any purpose, much smaller, and the number of those who are too tired after a hard day's work to read—enormous. But all except the

blind and deaf can see and hear." The teacher, then, should "show" as well as "tell."

Concreteness versus Verbalism

"In the beginning instruction was natural. The father taught the son how to hunt or fish; the mother showed the daughter how to prepare food. This realistic demonstration was accompanied by language to control the learner's thinking. The learning process involved seeing, hearing, and doing on the objective side and thinking or reasoning on the subjective. The eyes made the situation distinctly realistic; speech served to give it meaning; both resulted in a purpose to do; and doing brought about mastery. All these activities together made the learning as natural as the instruction.

"In the life of the pre-school child today both instruction and learning are still quite natural. The objective world approaches through the sense of vision, more or less enriched by other senses, and yields to a measure of conquest largely through the activity of manipulation. Language appeals simultaneously to the hearing and stimulates thought and purpose. Activity—both motor and cerebral —results in a steady growth of learning.

"It is only when the child advances in his school work that the situation becomes somewhat unbalanced. Seeing realities gives way to reading abstract symbols. Language no longer challenges for the reorganization of experience in the solution of a vital problem. Instead it sets up a series of artificial situations and attempts to provide the necessary facts for their successive solutions. In other words, language is forced to become a perplexing substitute for the actual reality. School tasks grow abstract, and learning becomes formal and unnatural.

"The history of education records a series of revolts against formalism. The very latest of these is the movement for more concreteness in instruction. The movement has received a special impetus by the perfection of photography, which offers us various media of manifest instructional value. These media are not true realities, but they are so realistic in contrast with the abstract nature of language that a question logically arises, namely: *Will the use of visual aids as an integral part of instruction effect economics in the educative process?*"[1]

[1] Weber, J. J., *Picture Values in Education*, Educational Screen, Inc., 1928.

In the final analysis, all learning is the result of sensory experiences, whether they be kinesthetic (touch), gustatory (taste), olfactory (smell), auditory (hearing), or optical (seeing). The forward-looking teacher, therefore, will multiply, whenever possible, the sensory experiences concerning an object, topic, idea, or event. The implication for the instructor is that he discover and use the various sensory experiences in the proportion that produces most effective results. Sensory experiences are not only necessary to more complete comprehension, but they are the key to the students' mental activity and future learning. Someone has said, "Children and adults are manipulators by original nature." All of us like to get our hand on novel and interesting objects because we crave first-hand experience. We all have the "let-me-try-it feeling." In short, an opportunity to touch, feel, handle, or operate a model or other object under discussion involves types of manipulatory activity that represent participation or self-activity which is so necessary for learning and always interesting.

Visual Teaching Aids and How They Help Learning

This particular discussion is concerned with the optical sense and its influence on learning. The teaching aids that appeal to the sense of sight vary in character, but they may be placed in four general classifications:

1. *Those of actual reality* or things themselves, such as tools, materials, machines, and similar concrete objects. Aids in this classification should be used whenever possible. The students' store of facts and knowledge is built up through experience with concrete objective contacts.
2. *Those of pseudo-realism*, the type of aid that is represented by a scale working model or diorama. This form is to be favored when it is not possible to use the real thing.
3. *Those of pictorial realism*, as exemplified by drawings, photographs, motion picture, and strip films of things and materials. In the absence of the object or material itself or a model, the pictorial aid will be most helpful.
4. *Those of pictorial symbolism*, found in graphs, schematic drawings, diagrams, etc. There are many cases in which this form of aid will help clarify the verbal explanation.

No one of these teaching aids may be sufficient in itself. The clever teacher will use a combination of aids when the situation will permit.

In each case, the visual stimulant will aid in creating the proper mental image for the learner and that is a true basis of learning. Oral or printed words usually mean nothing to a student until translated into a mental image. John Dewey has been one of the ardent exponents of the idea that learning will be facilitated if people form the correct mental images. His pedagogic creed includes these statements:

> . . . The image is the great instrument of instruction. What a child gets out of any subject presented to him is simply the images which he himself forms with regard to it.
>
> . . . If nine-tenths of the energy at present directed towards making the child learn certain things were spent in seeing to it that the child was forming proper images, the work of instruction would be greatly facilitated.
>
> . . . Much of the time and attention now given to the preparation and presentation of lessons might be more wisely and profitably expended in training the child's power of imagery and in seeing to it that he was continually forming definite, vivid and growing images of the various subjects with which he comes in contact in his experience.

The total effect of the visual aid is the important factor in the teaching situation. Such aids have certain distinct influences on the student and result in a more complete comprehension of the subject.

What Visual Aids Will Do

It may be well to explain briefly some of the specific ways in which teaching aids influence the learner.

1. *They Attract and Hold Attention*

A verbal explanation supplemented by a visual aid is far more effective in attracting attention and creating interest than if it is given unaided by such a device. This type of presentation adds variety and breaks the monotony of the ordinary instruction. Students may not be attracted by the mere description of various kinds

of woods and their finishes, but their curiosity and interest will be aroused immediately by a display of actual wood samples properly mounted and finished with a variety of pleasing stains and colorful paints. The concentrated attention and sustained interest developed this way are most important to learning. There is always a tendency for the mind to concentrate on the thing which the eye sees. Many times speakers will hold aloft a rather commonplace thing which invariably secures the prompt and concentrated attention of the observers.

2. *They Aid Retention of Information and Visual Images*

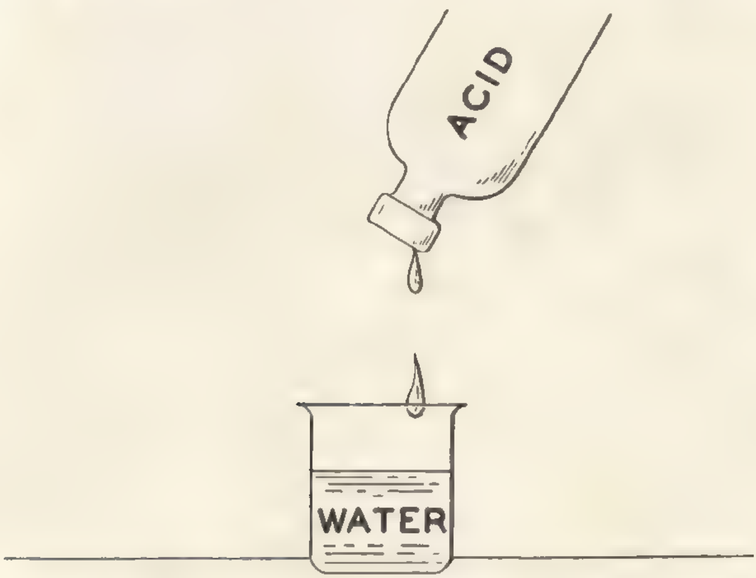
The major part of the things people hear are forgotten in a relatively short time and it is difficult to recall accurately what is heard. On the other hand the things they see make a more lasting impression and they experience considerably less difficulty in recalling the object or process with increased accuracy. The mental images created by pictorial stimuli and models are easy to recall because of the intense interest at the time of reception. Students have a greater interest in the realistic and concrete than they have in the abstract and symbolic. It is highly probable that the average person will easily forget the explanation of how an internal combustion engine operates; but if the explanation is accompanied by the showing of a real engine, a model, a film strip, or motion picture the impression is fixed and enables one to recall the operations without hesitation.

Every student of chemistry has been instructed to add acid to water and never add water to acid, but at a later date when the correct procedure is to be recalled there may be an element of indecision in his mind. It is not probable that this uncertainty would occur if the original verbal instruction concerning the proper method had been supplemented by a chart showing a large beaker labeled water and a hand holding a bottle marked "acid" from which the acid is dropping. The visual aid in this case reinforces the learning process by the use of an additional sensory experience.

In lieu of a chart the instructor could demonstrate the dropping of acid from a bottle into a beaker of water. In the future the relationship of the bottle and the beaker would be recalled by the mental image created rather than by a simple word memory of the correct procedure.

3. *Assist in Forming Correct Images*

People can interpret things only in terms of their own background of experiences; consequently it is possible and quite probable for a group of learners to form entirely different ideas about the same thing as a result of a verbal description. A piece of farm equipment, such as a mower, might be thoroughly described but, unless a person



1-1. A visual aid to impress upon the student that he is always to pour acid into water; *never* water into acid.

has seen one and has had farm experience, he may have an entirely wrong idea of such an implement. To form a more complete sensory impression, a picture or model must be used to supplement the explanation. It is amazing the number of errors which result from verbal instruction unaided by concreteness. Despite the axiom "seeing is believing," teachers continue to disregard this fact and indulge in verbal presentation without the aid of some concreteness in the form of models, charts, photographs, or the real thing.

4. *They Assist in Understanding Proper Relationships of Component Parts*

A visual aid, whether it be a model, sketch, photograph, or the thing itself, will establish in the mind of the student the proper relationship of the various parts of the object under consideration. This relationship must be understood to appreciate the function of each part as well as the working of the whole unit or mechanism. A verbal explanation is not sufficient to understand these relationships. The average mind cannot retain an involved word picture sufficiently long or clearly enough to result in a thorough understanding. The best explanation of an automobile gear shift or any other complicated device is highly inadequate without a working model, preferably of the cut-out type, by which one can observe the function and relationships of the shift lever, the gears, and the clutch.

Conclusion

It is to be concluded that teaching aids have a wide range of application, extending from the development of a factual memory to the recognition of things that flash on the screen for a fraction of a second. They serve to inspire action, create desirable attitudes, expedite the development of skills, orient people to new situations, and in general explain "how things work." The field of possibilities for construction and use of these aids is restricted only by the imagination and competency of teachers and school administrators.

In the succeeding pages will be found a discussion of the majority of teaching aids, old and new, known to the teaching profession. The advantages and disadvantages of the different types will be discussed, as well as their construction and use. The individual teacher will have to make his own choice of aids for the specific lessons to be taught and the particular information to be imparted.

References

1. Bell, Latin, Lamoreau, *et al.*, *Motion Pictures in a Modern Curriculum*. American Council on Education Studies. Motion Picture Project. American Council on Education, Washington, D. C., 1941.
2. Charters, W. M., *Motion Pictures and Youth. A Summary*, The Macmillan Company, New York, 1934.
3. Dale, Edgar, *How to Appreciate Motion Pictures*, The Macmillan Company, New York, 1935.

book rather than the subject. The textbook is only one teaching aid and it has limitations.

4. Textbooks are frequently arranged logically and fail to take into account the psychological factor in learning.

The Use of Textbooks

Much of the ineffectiveness of textbooks is probably due to improper use. There are many teachers who are critical of textbooks for one reason or another. These critics may be classified as follows:

1. Teachers who have discontinued professional progress after long years of service. They fail to keep abreast of the great improvements in textbook arrangement, style of presentation, and illustrations. They are thinking in terms of books that were new during the early days of their career.
2. Teachers who believe their knowledge of the subject is superior to that of textbook writers. They think the material they have assembled is to be preferred to that in textbooks, which is rarely true.
3. The third group includes those so-called "progressives" who want carte blanche in teaching. They do not like to be burdened by a textbook which would demand specific learning within the restricted subject. The textbook does retard digression, but it does not prevent the use of supplemental material.

The selection of a textbook is a serious matter when we consider the advantages and disadvantages that it may have for and the influence that it may have upon the multitude of students who will use it. There are a number of factors that are well to consider when making a choice. Although the content of a book is of prime importance, there are other criteria that should be applied. These will be discussed briefly to assist teachers in the appraisal of both text and reference material.

1. *Publication*

   a. *Title*—This may be considered as a minor matter, but unfortunately books are recommended sometimes solely on the basis of the title. It is discovered later that little relation-

ship exists between the title and the content. It is therefore well to discover whether or not the title is explanatory, appropriate, vague, or misleading.

b. *Author's reputation*—The reputation of an author usually has considerable influence on the person selecting a text. It does not necessarily follow, however, that an unknown person may not produce a most desirable piece of work. A newcomer to the field may be connected with a good organization where the facilities and the experience for writing a good book are available. Therefore, the name of the writer is of minor importance when compared with the content.

c. *Date of copyright*—This is an important factor in the selection of a textbook for a particular course of instruction. If a choice is being made in such subjects as history, geography, electronics, plastics or radio, then the copyright date is important. In these subjects the possible content is constantly changing because of rapid social and scientific progress. A year may make much of the subject matter obsolete. Therefore, in appraising a book it is advisable to check the copyright date.

d. *Book review comment*—The opinions of professional reviewers are worthy of consideration because of their honesty and ability to weigh carefully the omissions and commissions of the author.

2. *Mechanical construction*

a. *Size*—This is an item worthy of consideration. If a book is large and clumsy to handle, it is inconvenient and antagonizing to the user. If it is small or an odd size, again, the user is annoyed.

b. *Binding*—This is an important factor when appraising a book for adolescent use. Only textbooks with a cloth or imitation leather binding should be purchased. The commonly known workbook, which is expendable, is satisfactory when bound with a durable cover stock.

c. *Paper*—A good grade of dull finish paper is desirable to minimize eye strain and to withstand repeated use.

d. *Format*—The general appearance of the book is important

from the standpoint of arousing interest in and respect for the content. A solid printed page is monotonous and unattractive. Consequently, the book that has an interesting format, a generous supply of illustrations, and varied type faces for emphasis demands attention and creates interest.

3. *Content*

This is without question the most important factor in the book. When selecting a book for any course it is well to ask the following questions:

a. Does it meet the real need of those to be taught?
b. Is your thinking on the subject in line with that of the author?
c. Is the content arranged in a logical teaching sequence?
d. Is the subject matter complete and up-to-date?
e. Is the amount of space devoted to the various topics in relation to their importance?
f. Is the language used within the comprehension of those who will use it?

4. *Illustrations*

When appraising a book for illustrations the following questions may be asked:

a. Are the illustrations sufficient in number to enable greater comprehension of the text?
b. Are the illustrations well selected to support the text or do they only break the monotony of a solidly printed page?
c. Have charts, diagrams, and graphs been used to aid understanding?

5. *Aids in the use of a text*

a. Is the index comprehensive, and does it carry sufficient cross references?
b. Is the table of contents complete enough to minimize the difficulty of locating specific topics?
c. Is there a teacher's manual of suggested use?
d. Are there any special student helps such as a student guide, special glossary of terminology, a laboratory manual, or any other supplementary material for student aid?

6. *References*

These are valuable in most books, and when reviewing a book the following measures may be used:

a. Are the references sufficiently specific?
b. Are they listed at the end of each chapter?
c. Are they carefully selected?

7. *Use of the book*

The final selection of a book should depend on how it will be used. The answers to the following questions will aid one's decision:

a. Is the book suitable for a basic text?
b. Should it be purchased for reference purposes only?
c. Is it well adapted to the objectives of your course of study?
d. Should a copy be purchased by or for each student?
e. Is the sequence of the material arranged in accordance with the laws of learning?

If the above suggestions for book appraisal are used, it will be possible to avoid the mistakes of snap judgment and superficial examination.

II. The Demonstration

The rather hackneyed phrase, "I'm from Missouri, you've got to show me," implies that one should demonstrate rather than talk about it. Although teachers consider the demonstration method as just another technique of teaching, it includes the use of the real tools, machines, charts, models, and apparatus pertinent to the subject and therefore is an excellent form of *visual instruction*. Again the *appeal* is *made through the sense of sight* and therefore is most effective. Commercial organizations appreciate the value of the demonstration as a most effective means of developing customer appeal. It is teaching people to use a device or to appreciate the value of a commodity by "showing and explaining."

"A demonstration is a planned performance whereby one or more persons attempt to instruct, or inform, others, by actually performing

the act in a way that makes it clear and understandable to the observer. It is the clarity with which the act is performed that determines the value of the demonstration for instructional purposes. The more the observer sees and understands, the more successful the demonstration will be. Thus, it is easy to see why the demonstration should be clearly visible, performed slowly enough to be grasped by the learner, broken down into elementary steps, and accompanied by a verbal explanation."[1]

Certain techniques are necessary for a satisfactory demonstration. The following are advised:

1. Anticipate those steps which may cause the greatest difficulty, and provide, or have ready, some form of supplemental instruction to clarify the point.
2. Have all materials and equipment needed for the demonstration at hand and within easy reach.
3. Go through the demonstration as a rehearsal before the actual presentation; be sure that everything works as planned.
4. Remember to give short demonstrations to avoid fatigue of students and to help the retention of things presented.
5. Remove all possible distractions before the demonstration begins—unnecessary noise, glare, unused equipment, etc.
6. Explain each step as you perform it, telling *why*, as well as *how*, whenever it can be done without going into a lengthy discussion.
7. Be sure that everyone can see; the worth of a demonstration is measured by its visual appeal.
   a. Use large objects, equipment and drawings.
   b. Be sure that glare from light sources and shiny surfaces is avoided. The light source should be invisible whenever possible and always outside the line of vision.
   c. Hold your work aloft where all can get a good view.
   d. Stand at the side of your drawing, chart, or model, particularly when it is on the board behind you.
   e. Be sure that you have sufficient illumination on the demonstration (25-50 foot-candles). Visibility increases sharply as the level of illumination rises above the usual low level found in many schools.

[1] Bollinger and Livingston Methods of Teaching Industrial Subjects.

8. Support your demonstration with pictures, charts, diagrams, models, slides, movies, and printed instruction material. These aids will help individual students interpret your discussion. They clarify obscure points, provide material for continued study, and serve to emphasize important points. Visual aids are just as valuable in a demonstration as they are in any other method of presentation.
9. Do the demonstration yourself in a most skillful manner; so well in fact that it will incite wonder and admiration for your ability. Avoid the danger, however, of overawing the learner to the point of discouragement or of creating an impression that you are "showing off."
10. Have all students see the demonstration from the angle in which they will see it when they do it themselves. A teacher facing a group actually reverses his motions with respect to the learner. In certain cases, such as the demonstration of the tying of a knot, this reversed procedure becomes more confusing than helpful.
11. Have only *one* thing going on at a time. Although explaining as one goes along is a good practice, there is the danger that merely talking continuously will, in itself, become a counter-attraction and divide the interest. *Converge*, or focus, attention on the one thing you are doing; do not disperse it by sideshows or mental byways.

The demonstration is particularly valuable in teaching anything involving skills, tools, materials, procedures, and concrete things, as opposed to abstract subject matter. The values of the demonstration method from the standpoint of visual instruction are many. It substitutes action for words, creates correct mental images in lieu of word images, replaces mere explanation with reality, attracts and concentrates attention, maintains continued interest, and makes possible correct recall with less effort.

III. The Blackboard

The blackboard, although itself not a visual aid, is the most common and generally accepted medium of visual instruction. Teachers in general and vocational teachers in particular should develop expert skill in the use of this teaching tool. Well-executed picture

drawings, diagrams, and graphs will reduce the necessary amount of verbal instruction and aid the learner in understanding and recall. The majority of teachers have failed to appreciate the advantages of blackboard presentation and therefore they have made no special effort to become proficient in its use.

It has numerous advantages—a few of which will be described briefly.

1. It is most convenient; every schoolroom, shop, or teaching center invariably has blackboard facilities. Because of its accessibility, the instructor can use it throughout a lesson to list, describe, or sketch his ideas as the instruction demands.
2. It is a very flexible medium of instruction, and its use is limited only by the versatility of the teacher. In this chapter, a variety of techniques in the use of the blackboard will be presented. Of all teaching aids it is probably the most adaptable to the changing requirement of the teaching job.
3. It encourages student attention and participation. The activity of the teacher at the blackboard attracts attention of the learners and encourages their participation in the development of the lesson. The students not only contribute to the various steps of the lesson, but also establish their own speed of absorbing the content presented.

A good teacher will make extensive use of the blackboard during class presentations to vitalize the instruction. It is well to write on the board new technical words used, the names of machine parts and operations, in addition to well-drawn diagrams and sketches. The following techniques are presented to improve the instructor's efficiency and artistic ability in the use of the common visual aid.

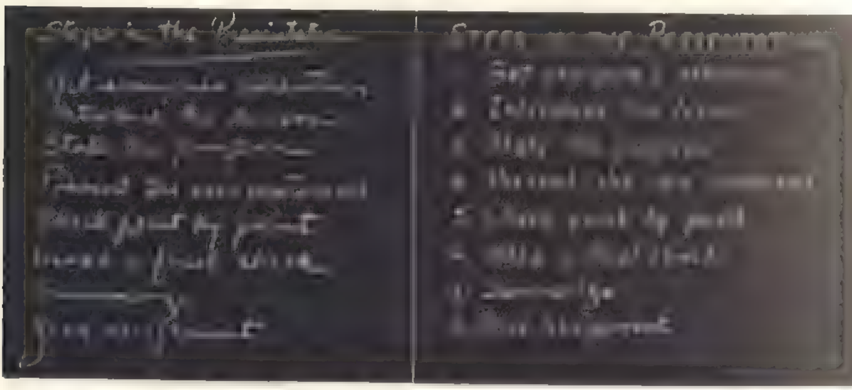
Writing and Lettering on the Blackboard

A blackboard may be a teacher's best friend, but it can't help you if your writing is unreadable or your lettering meaningless. Use the blackboard—do not abuse it. Your writing or lettering should have:

1. Full, well-formed letters, uniform and well spaced.
2. Sufficient size so that all can see and read without difficulty.
3. A feeling of roominess and order.

4. Lines formed parallel to the board.
5. Words spelled correctly.
6. A neat and orderly appearance.

When you have difficulty writing clearly, print or letter your material instead. Lettering is more legible than script and generally easier to do. Note the two examples in Figure 3-1, both made by



3-1. The person who wrote this .... printed this.

the same instructor under normal teaching conditions without the assistance of any special instruction.

Improve your lettering by practice; avoid these pitfalls:

1. Trying to rush your lettering—form each letter carefully.
2. Irregular spacing—keep the areas between your letters uniform.
3. Crooked lines—use light guide lines if necessary.
4. Uneven letter size—guide lines will help.
5. Uneven line spacing—lay off spacing with a rule.
6. Poorly formed letters—keep them round and full; read and follow the instructions found in any good mechanical drawing book.
7. Unnecessary frills—use a good, straightforward Gothic letter such as that generally used by engineers.
8. Crowded work—plan your layout of material; use headings, margins, indentations, single and double spacing, etc.
9. Monotonous appearance—get emphasis and variety by using

capital and small letters, underlining, italics, and colored chalk.

Examine your blackboard work from the back of the room, looking at it from where the student sees it. Keep in mind as you use the blackboard that you are putting on the material for the benefit of the students who will view it from ten to thirty feet away. Make drawings and writing large.

3-2. A 3-inch letter on the blackboard appears about 1/20 as large to a student at the back of the room as it does to the teacher making the letter on the board. *(Courtesy American School Board Journal)*

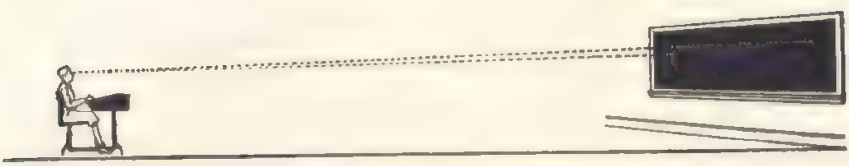


Figure 3-2 represents the seeing difference between the teacher at the board and the student seated near the back of the room. In an article appearing in the *American School Board Journal*, William G. Darby says, "A 3-inch character is about 4/100 as 'large' when seen by the student at the back of the room (26 feet) as it is when seen by the teacher at the board." [2]

Plan your blackboard work and use it as a means of communication—"a sort of visible voice." Try out your sketches before you are ready to use them. Erase things no longer relevant to the instruction, but be sure you provide an opportunity for your students

[2] Darby, W. G., "Seeing in the School House," *American School Board Journal*, August, September 1945.

to copy important material. Make certain that all can see what is on the board and then use a pointer to single out specific data. This concentrates attention on the point under discussion and avoids obstructing the learner's view.

"My writing is terrible"; "It takes too much time"; "I can't draw"; and "I have no facilities"—these are no excuses for avoiding the blackboard. If you don't know, it is your responsibility to do something

3-3. Blackboard illustration showing the steps in developing a freehand sketch. (1) Rough outline. (2) Outline erased lightly to leave faint image. (3) Finished line traced in.

3-4. Blackboard illustration laid out by use of center lines and dots to establish proportion, size, and shape of object.

about it or you are not seriously interested in teaching. Blackboards do not have to be mounted permanently on the wall—small portable boards that can be hung or rolled about may serve your needs best. The man who says, "I'm sorry I don't believe I can go on; I haven't any more chalk," need have no fear about his teaching success.

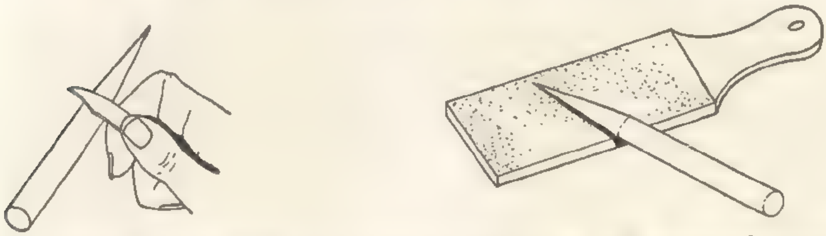
How to Make Blackboard Drawings by Freehand Sketching

Well-drawn blackboard drawings can be sketched freehand by using the same technique as that employed when sketching on paper.

1. Sketch in the general outline by using light, overlapping strokes to give the desired proportion and shape. This provides a guide or framework for detail and the final solid line of the drawing.

2. Erase all the unnecessary lines and retain only a very faint trace of the desired outline.
3. Retrace the outline with a good, strong, solid line and add any detail required to complete the drawing. Figure 3-3 shows a drawing in each of the above stages of preparation.

Sketching may be facilitated, particularly large drawings, by first placing dots at the corners or the key points to establish the general



3-5. Chalk may be sharpened like a drawing pencil; shaped with a knife and pointed sharply with a sandpaper pad.

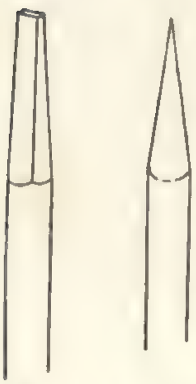
proportions and layout of the drawing. These points can then be connected by the sketching technique just described. Drawings which involve circles, arcs, and symmetrical layout should have their centerlines drawn first. Centerlines serve as guides for the axes on which the circles are formed and as a means of alignment when several parts are centered around a common axis. Figure 3-4 illustrates both the use of centerlines and dots as guides in the making of a sketch. In this case the centerlines were the first to be placed on the board, followed by the dots on the various axes, then the sketched outline, and finally the final finish line. The illustration shows some part of the drawing in each of the four stages.

Some teachers believe that clearer and more uniform lines can be obtained by shaping the end of the chalk with a knife or a piece of sandpaper. This is done in the same way as a pencil would be sharpened. The shape of the point will be determined by the work to be done and the preference of the one doing the drawing. The chalk may be sharpened to a wedge shape (Figure 3-6A) for drawing straight lines. By turning the face or the edge toward the board either broad or narrow lines can be drawn. The round-pointed chalk (Figure 3-6B) can be used for irregular and detail lines or for

straight lines. When drawing straight lines with pointed chalk, the chalk should be slanted in the direction in which the line is being drawn and revolved between the fingers as the line is drawn. Rotating the chalk maintains a uniform width of line just as it does in using the pencil.

Blackboard Drawing Devices

Some forms of blackboard illustration, such as machine drawing and sheet-metal layout, require greater accuracy than can be obtained by the freehand method. For this purpose special blackboard drawing instruments and devices have been designed. Blackboard drawing instruments are really oversize mechanical drawing tools made of wood. They are easy to construct or may be purchased from any school or drawing supply company. The instruments usually consist of a compass, a straightedge, a triangle or two, and sometimes a protractor and an irregular curve. The first four are shown in Figure 3-7. These instruments are used in the same manner as their smaller brothers and require some form of parallel guide to give maximum satisfaction.



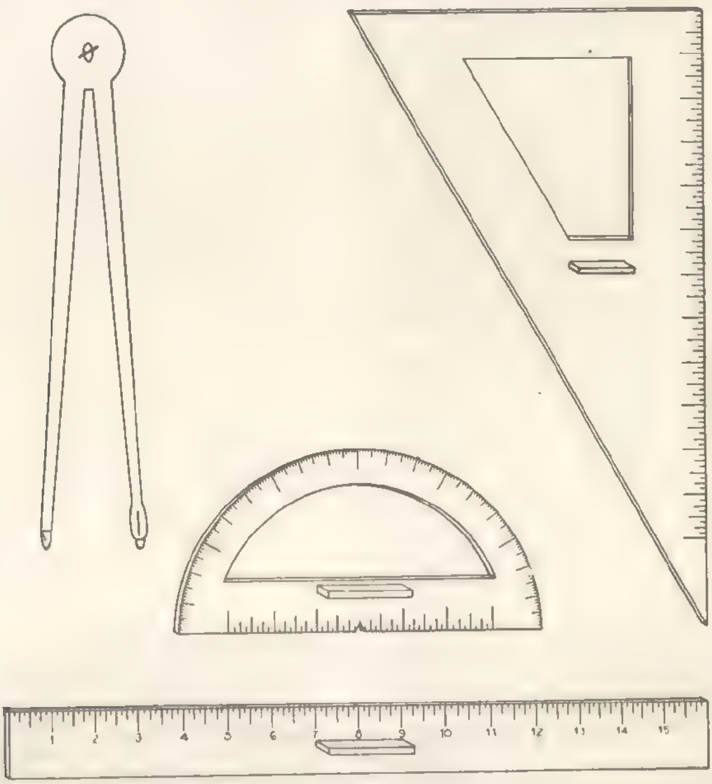
3-6. Like the drawing pencil, chalk may be sharpened (a) wedge-shaped for straight lines or (b) conical for curved and irregular lines.

Another blackboard device for drawing several parallel lines at the same time is shown in Figure 3-8. The holder illustrated is designed to draw five equally spaced lines, such as is required by music teachers; it is, however, adaptable to other types of work. For example, it can serve as a lettering guide by omitting the middle chalk and using the lines thus formed for lettering as shown at the right. Many similar adaptations or modifications are possible for meeting other drawing needs.

Circles of reasonable accuracy can be drawn freehand by using the elbow or some point between the elbow and the wrist as an imaginary center and completing the circle in one sweep of the arm. The circle is started at the bottom with the person standing in the position shown in Figure 3-9. Draw the circle with a fast sweep of the arm in a clockwise direction, stepping to the left as the circle is

completed. A little practice with this method will produce surprisingly accurate circles with a smooth, quick sweep of the arm.

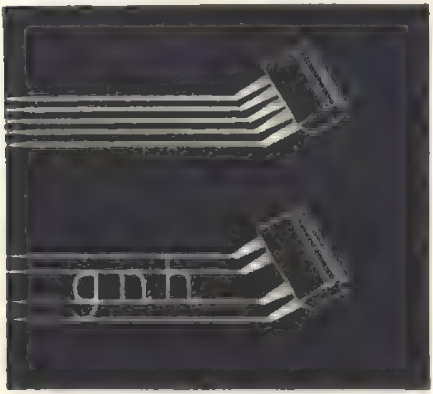
More accurate circles and arcs can be drawn with the aid of a piece of string. The string should be tied near one end of the chalk,



3-7. Special large-sized blackboard drawing instruments make accurate blackboard drawings possible.

using the knot shown in Figure 3-11. Tie the string near the end of the chalk to reduce the possibility of varying the radius of the circle by tipping the chalk. The best knot for this purpose is shown in Figure 3-11. It is quickly tied and will hold securely. The circle is started at the bottom in the position shown in Figure 3-9. Note that the string is held in place at the center of the proposed circle by the thumb of the left hand. As the circle is formed, the thumb must ro-

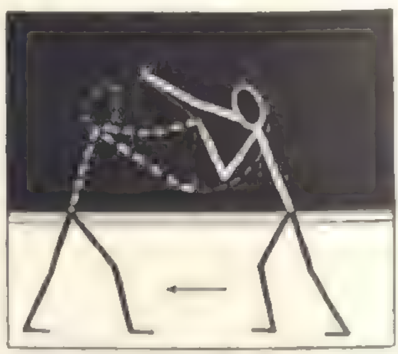
tate with the string to avoid winding the string about the thumb, thus changing the desired radius. Note also the shift in body position from right to left as the circle is drawn in a clockwise direction (Figure 3-10). Accurate circles and arcs can be drawn only if the following precautions are observed carefully.



3-8. The multiple chalk holder long used by music instructors for drawing the five lines of the staff is useful for lettering and drawing parallel lines for any purpose.

1. Do not allow the string to wind up on the chalk.
2. Point the thumb in the direction of the string and maintain this relationship throughout the entire circle or arc.
3. Do not allow the thumb to move off the established center.
4. Keep the string close to the end of the chalk which is doing the drawing.
5. Hold the chalk perpendicular to the board but slanting slightly in the direction of travel.

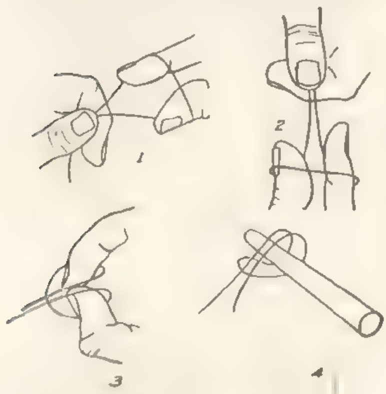
3-9. To draw a circle on the blackboard with a string and piece of chalk begin at the bottom of the circle and swing the chalk in a clockwise direction. Note that the right arm must be crossed over the left and that the person stands to the right of the center point.



3-10. Note how the position of the body shifts to the left as the right half of the circle is completed.

6. Start at the bottom of the circle and swing the arc or circle in a clockwise direction.
7. Shift the position of the body from the right side of the circle to the left as the circle is being formed.
8. Draw the circle in a smooth sweep with most of the movement coming from the shoulders and the position of the body.

Another simple device to aid in making accurate circles is the small suction cup available at the hardware and the five and ten stores. The suction cup can be located at the desired center and serve as the pivot for forming the circle. With two cups an ellipse can be formed by the simple string method. Both applications are illustrated in Figure 3-12.



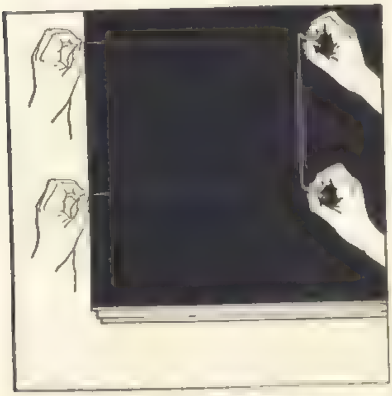
3-11. Steps in tieing a simple slip knot so useful in fastening the string to the chalk preparatory to drawing a circle or arc.

3-12. Drawing an elipse on the blackboard with string and two vacuum cups serving as the centers.

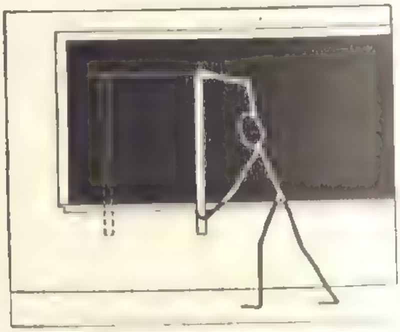
Horizontal and vertical lines can be drawn quickly and easily without special equipment by using a piece of string, a yardstick, a pointer, or some similar device, and the edge of the board or the chalk rail. When string is used, it should be fastened to the chalk with the knot previously described. With the frame or the chalk rail of the blackboard as a guide both vertical and horizontal lines can be drawn in any position on the board with surprising accuracy. Figure 3-13 shows the position of the hands with relationship to the string and the board in drawing vertical lines. Note how the flat

side of the thumbnail serves as a contact point against the edge of the blackboard frame. The vertical line is formed by moving both hands downward simultaneously and keeping the string taut.

A yardstick, a pointer, or other similar device can be used in much the same way as the string for drawing horizontal and vertical lines.



3-13. Drawing vertical lines by using string and the blackboard frame as a guide.



3-14. Using a yardstick, pointer, or straightedge and the chalk rail as a guide for drawing horizontal lines.

3-15. Using a sliding parallel rule and blackboard triangle for drawing horizontal, vertical, and slanting lines.

3-16. Using a jumbo-sized triangle placed against the frame or chalk rail of a blackboard for drawing horizontal, vertical, and slant lines.

In this case the chalk is held against the end of the stick with the right hand, and the thumb of the left hand again serves as the guide along the chalk rail or the side member of the frame surrounding the blackboard. Figure 3-14 pictures a horizontal line being drawn with the chalk rail serving as the guide. The same precaution of moving the hands together and at the same rate applies here as it does in using the string for this same purpose. Obviously the position of the line on the board will be determined by the position of the left hand on the stick or string.

A novel and frequently useful method of drawing straight lines is that of stretching a chalk line taut, then picking it up near the center and allowing it to snap back into position. The impact against the board leaves a chalk-dust line which can be easily traced. Carpenters and builders have long used this device. It is necessary to chalk the cord frequently if a clear mark is required.

Parallel rules, such as those sold by drawing supply companies, may be attached to the blackboard just as they are on a large drawing board. Figure 3-15 shows a homemade version which has proved satisfactory and which can be constructed with little trouble. The use of the rule is very simple. As the rule is moved up and down on the board, the cords, to which it is fastened, automatically keep it in a parallel position. Thus all horizontal lines are drawn by merely moving the rule into position. Vertical and angular lines are drawn in the conventional manner by placing the triangle on the top edge of the rule and sliding it along to the desired points.

A very simple but exceedingly practical plan to draw vertical, horizontal, and parallel lines on the blackboard is illustrated in Figure 3-16. Two straightedges have been attached to the left side and the bottom of the blackboard, forming an angle of exactly 90°. A 30-60 triangle sufficiently large to reach across the blackboard is placed against either straight edge to produce vertical and horizontal lines. By moving the triangle along the straight edges, parallel lines can be drawn over the entire surface of the board. This simple equipment supplemented by a 45° triangle and a blackboard compass is sufficient to reproduce most mechanical drawings on the blackboard with speed and accuracy.

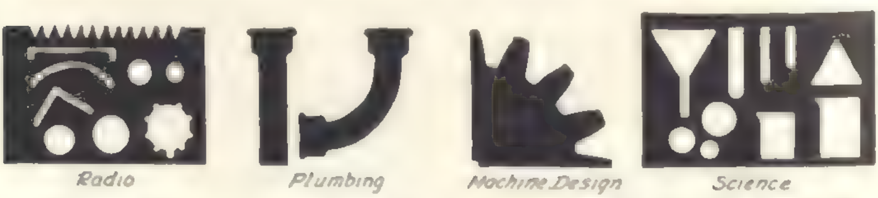
Blackboard templates are desirable whenever some basic outline or shape is to be drawn on the board repeatedly. Whenever the drawing is needed, the template can be held against the board and

used as a guide to draw the outline quickly and probably more accurately than if drawn otherwise. Figure 3-17 shows an instructor in electrical work using a drawing the basic part of which was made with the use of the template hanging at the top of the board on the

3-17. Templates such as the one hanging at the top of the board speed up blackboard sketching as well as improving the accuracy of the sketch.

right. In this case the frame and pole-pieces are used frequently in connection with a variety of circuits, hence the value of using the template and having it conveniently located.

Other suggested templates that have proved useful or that offer possibilities are shown in Figure 3-18. These may be constructed of

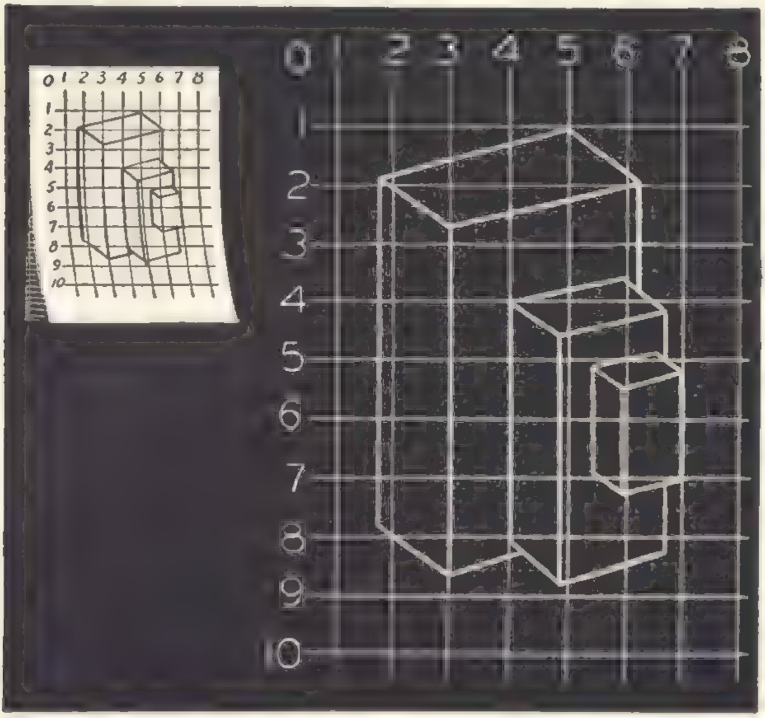


3-18. Some templates suggestive of those which will be found useful in special subjects.

any light, thin material of sufficient stiffness to withstand extensive use. Thin plywood, fiberboard, "pressboard" or the ⅛-inch Presdwood makes satisfactory templates.

Special templates of this type have not been available commercially. When laying out one for your own use, first make the desired

drawing full size on the blackboard or on a large sheet of paper held in place on the board. This assures the correct proportion and size required for your purpose. The drawing must then be transferred to the material being used for the template. Beveling the edge against which the chalk will bear will improve the accuracy of the drawing, particularly if the material is greater than ⅛ inch in thickness.



3-19. Using the square method of transferring and enlarging from a small original to the blackboard.

How to Transfer Drawings to the Blackboard

Drawings which are too difficult to draw freehand can be put on the blackboard even by one with little drawing ability by using one of the mechanical methods of transferring copy from the original. At least three practical methods are available: the square method, the projection method, and the pounce method.

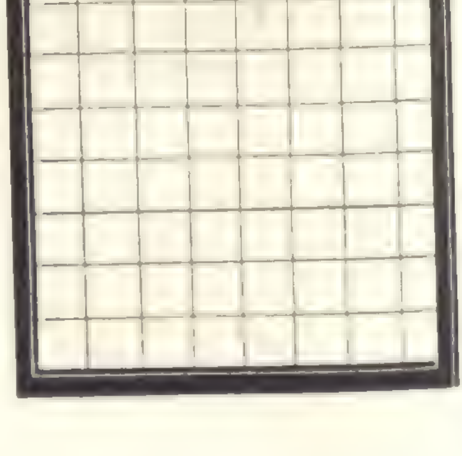
1. *The Square Method*

This method requires no special equipment. The original copy is divided into uniform squares by ruled lines. The size of the squares are determined by the size of the original copy and the accuracy with which the copy must be reproduced. The smaller the copy and the greater the accuracy required, the smaller the squares must be. The blackboard is then marked off lightly in larger squares proportional to the desired increase over the original. For example, if the copy is ruled off in ½-inch squares and the blackboard drawing is to be four times as large, the blackboard squares must be four times as large, or 2 inches in this example.

Blackboards may be permanently ruled in squares by scoring the lines lightly with a sharp scriber. A very satisfactory semipermanent ruling can be done with India ink. A special device for this purpose has been available through school supply houses. Neither method will interfere with the normal use of the blackboard, although the scored board is probably the more noticeable of the two.

When it is not desirable to score or mark the board permanently, a squared outline may be projected onto the board either with the use of a specially prepared slide and a projector or a specially prepared sheet in connection with an opaque projector. This arrange-

3-20. A scribing device to rule permanent lines on a blackboard to serve as a guide in sketching and lettering.



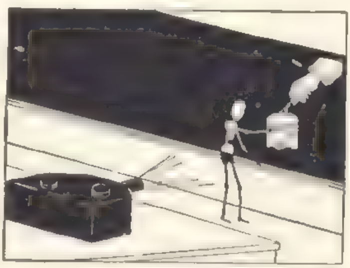
3-21. A 3¼" x 4" translucent lantern slide may be ruled with pencil or India ink and projected on blackboard as a guide for sketching and lettering.

ment has the advantage of being able to vary the size of the square by moving the projector closer or further away from the board. The slide is prepared by ruling squares on any pieces of transparent material (e.g., a cleared piece of cut photographic film or a piece of frosted glass). The material should be cut to the size of the slide (3¼″ x 4″ or 2″ x 2″) and mounted in the usual manner described in detail on page 190. Other slides can be prepared representing various forms of graph paper and then projected to form the basis of drawings and graphs suited to their use.

2. *The Projection Method*

Drawings can be transferred to the blackboard with the usual lantern slide projector, the 2″ x 2″ film-strip projector, or the simple opaque projector described on page 148. The slide projector necessitates having the material to be transferred in slide form. Because of this it may often be advantageous to use the projected picture directly rather than use it in making a blackboard drawing. In special cases, however, only parts of a drawing or only an outline is needed, and the slide may well furnish this portion for blackboard use. The opaque projector has an advantage in that it can project the original picture, which may be a photograph, a clipping, an illustration in a book, or the actual object itself.

Whatever method of projection is used, the room must be partially darkened and, in the case of the opaque projector, the room must be well darkened. The size of the projected image can be adjusted by moving the projector toward or away from the board. The image itself can be easily traced with white chalk or with colored chalk should a colored projection be desired.



3-22. Projecting a picture on the blackboard with an opaque projector in order to make a tracing of it on the blackboard.

3. *The Pounce Method*

This method of transferring a drawing to the blackboard is similar to that used by signpainters in transferring their sketches to glass or other material preparatory to painting. The process is compara-

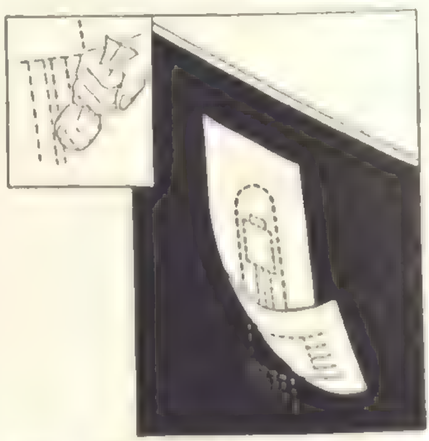
tively simple and exceedingly useful when the same drawing is needed on the board repeatedly. The method consists of preparing a perforated paper pattern and transferring this pattern to the board by means of a pounce (usually a talc powder) applied by patting the surface of the pattern with a small dusting bag. When the paper is removed, the outline on the pattern will appear on the board ready to be traced with the chalk.

First step in the process is to reproduce the drawing on a large piece of brown wrapping paper exactly as it is to appear on the blackboard. This may be done by freehand tracing or by projection as described on page 140.

Second, trace the lines of the drawing with a sharp-pointed tracing wheel. During this step the paper should be placed over a large heavy piece of cardboard so that the points of the tracing wheel can penetrate through the paper sufficiently to produce clean, clear-cut perforations (Figure 3-23). Inspect the completed pattern by holding it up to the light to be sure it is clearly cut and complete.

Third, place the completed pattern in position on the blackboard and fasten it in place with masking tape or some other form of adhesive that can be removed easily.

3-23. Making a pounce pattern by tracing the drawing with a tracing wheel



3-24. Transferring a pounce pattern to the blackboard.

Fourth, dust the entire outline of the drawing by patting with a small dusting bag of talc (Figure 3-24).

Fifth, inspect the transferred drawing by lifting the pattern up from the bottom and examining it for clearness and completeness. Correct wherever necessary and then carefully remove the entire pattern.

Sixth, trace the talc image formed on the board with chalk immediately after removing the pattern since the talc image is exceedingly perishable.

Seventh, add small details and shade freehand to complete the drawing.

Drawings made this way can be done very quickly and with considerable accuracy once the pounce pattern is available. Patterns can be rolled and stored away for later use and, if given reasonable care, will last indefinitely.

III. The Bulletin Board

The bulletin board is a teaching tool of wide usage and standing. It has been used effectively to inform students, to influence their behavior, and to motivate them to action. In many cases, the bulletin board is used almost exclusively for routine messages, a use which falls short of its potentialities. If it is well designed and its use is thoroughly planned, it is a potent instrument of instruction. Its purpose should be threefold:

1. To present new and interesting ideas and information. One section of the board may be reserved and labeled for things of this nature. The instructor should be on the alert for new devices, new ideas, and timely developments that may be of interest and prove helpful to the learners.
2. To portray, by pictures, cartoons, and posters, matters pertaining to safe practices. Safety is of such great importance that it should be continually emphasized through the bulletin board, and ample space should be provided for this purpose. There are many sources of excellent safety material that will permit attractive displays at all times.

3. To dispense current information by means of notices, rules, and regulations. A section of the board should be reserved for timely notices to which reference may be made at all times.

Construction and Location of the Bulletin Board

Bulletin boards may be purchased from school supply houses, or they may be custom-made to fit a specified space in accordance with the ideas of the individual teacher. There are certain features of construction that should be kept in mind when providing a board for the classroom or shop:

1. They should not be too small and thereby definitely limit the size of display material to be used. On the other hand, they

3-25. A small but very effective bulletin board for classroom or shop use.

should not be excessively large because considerable space would not be occupied, which would detract from its effectiveness. Furthermore, if a board is particularly large and a variety of material is displayed, the result tends toward confusion. In general, a board 30″ x 36″ will satisfy a majority of situations; however, 36″ x 60″ is not too large if its use is well planned and executed. (See Figure 25.) In the last analysis, the size will be controlled by the location selected.

2. The materials used in bulletin board construction vary from rough boards, Celotex and Masonite, to cork. Despite the material used, the board should represent good workmanship. In some cases, an improvised board may be justified, but in general a well-constructed and attractive board should be provided.
3. The open board is generally adequate for a classroom or shop if it is well managed. There is something to be said in favor of an enclosed board with glass doors. In this case the displays are kept clean, not disturbed by contact, or removed by air currents. This style of bulletin board is particularly desirable for hallways or places not directly controlled by the teacher. The doors should be locked to prevent indiscriminate places of notices, pictures, and miscellaneous items on the board. It is always desirable to provide for indirect lighting in the enclosed board, thus increasing its attractiveness as well as adding to its utility.

The Use of the Bulletin Board

There are numerous ways in which a bulletin board may be utilized, of which the following are but a few.

1. Daily clippings should be displayed that refer to important local happenings, discoveries, inventions, legislation, activities of famous people, and world events. These things need not be attached to any one subject or class, as they should be things that an alert citizen should know. Such a section of the board should be headed by a suitable caption, for example, "Do You Know," or "Facts You Should Learn," or "Stop—Look—Read."
2. Special days or public occasions should be emphasized by suitable bulletin board displays. The occasion may be a national holiday such as Thanksgiving Day or Washington's Birthday. In the former case, it is possible to stimulate the proper attitude of appreciation toward this land of opportunity and freedom, while, in the latter case, respect and admiration may be developed for a great national leader.
3. The bulletin board may be used to arouse interest and activity in support of a local charity or event. A Red Cross

drive provides the opportunity to assist by the display of suitable posters, photographs, and statistics of accomplishment of the organization. The same is true of such a celebration as Founder's Week. In either case, the displays will act as a motivating force for action and co-operation on the part of the students.

4. Again, students may be stimulated in desirable ways through the use of the bulletin board during such periods as Safety Week, Health Week, Mother's Day, and other times when selfish motives may be the basis of the appeal. The magazines and organizations representing these activities are valuable sources of posters, photographs, and circulars suitable for display purposes. Much may be accomplished in generating desirable habits and attitudes by exploiting the opportunities presented at these stated times.
5. The display of student work, whether written or actual projects, serves as a stimulating force for greater student effort. It is an appeal to very strong human traits—those of personal recognition and competition. In addition to display of school assignments, it may be desirable to show the work accomplished through hobbies. In either case, the students are encouraged or prodded to put forth their best efforts.
6. There are times when the teacher may wish to put across certain lessons in courtesy, safety, school spirit, patriotism, or some other feature of character development. The bulletin board is a very good silent partner in handling such activities, through the media of charts, cartoons, pictures, mottoes, and other printed material. The teacher should develop a comprehensive file of things to be used in this way.
7. The classroom bulletin board may serve as a supplement to the teacher's instruction in teaching specific lessons. If the topic of abrasives or cabinet woods is to be discussed, there should be arranged for the bulletin board attractive displays of samples, photographs, and circulars, covering these subjects. Such displays should appear prior to the day of discussion in order to arouse interest and curiosity on the part of the students. In practically all cases, the co-operation of the

students should be enlisted in planning and arranging such displays. They should be encouraged to find material suitable for use and given the responsibility for its arrangement.

8. There is need for developing good taste in art, reading, and other cultural pursuits, and again the bulletin board may serve as the medium through which desirable results may be secured. Attractive prints of famous paintings may be purchased or borrowed for display. Lists of good books, past and contemporary, with motivating slogans, should appear at stated periods. Samples or pictures of good craftsmanship should be displayed from time to time as a stimulating force for the future craftsman in the vocational school.
9. Although the displays may be attractive and speak for themselves, it is necessary for the teacher to direct the attention of the students to them. There should be some discussion concerning the display and its connection to the work or topics at hand.
10. It is a good technique to delegate to students the bulletin board display covering specific phases of work. The teacher should guide the project but depend on the students to secure the materials and place them on display.

The above list of suggestions is adequate to provide comprehensive bulletin board activity over a long period of time. The resourcefulness of the teacher is the controlling factor in bulletin board use and effectiveness.

Management of the Bulletin Board

1. Organize a tentative calendar for the term or year and avoid last-minute planning and searching for ideas.
2. Defer your planned schedule in favor of current or timely topics.
3. Secure display ideas from advertisers, store windows, and magazines.
4. Vary the subject matter of displays to maintain interest.
5. Keep a file of good bulletin board material for immediate use.
6. Keep on hand a supply of thumbtacks, ink, Scotch Tape, colored map tacks, colored crayons, and other essential supplies.

7. Change displays frequently—prevent material from "going stale."
8. Inject humor, if appropriate with a message—avoid the bizarre—use good taste.
9. Make displays neat, simple, and striking.
10. Project a single idea with each display.
11. Use attractive color, but avoid the garish; attract attention, but do not offend the eye.
12. Displays are more effective if large enough to be seen from a reasonable distance.
13. Avoid crowding of display materials.
14. Use captions and slogans that are brief, clear, and forceful but never hackneyed.
15. Employ lettering that is in good taste, simple, neat, well spaced and in harmony with the display.
16. Avoid detailed explanations—they will not be read.
17. In general the exhibit should be:
    a. light against a dark background.
    b. dark against a light background.
    c. colorful against a neutral ground.
    d. neutral against a colored ground.
18. Use colored Scotch Tape for divisions, underlinings, etc.
19. Use colored pencils to frame things and to underline statements.
20. Avoid too many colors and colors that clash.

The alert teacher will have available a bulletin board in the classroom or shop and will utilize it continually as an additional medium for visual instruction.

The Hall Display Case

This is another effective type of teaching aid which schools should use extensively. Its use is controlled by most of the factors that pertain to the use of bulletin boards. The one "must" is adequate illumination.

The advantage of the display case is the opportunity it affords to show things in the third dimension. The objects should be carefully labeled and given the proper background to display them to the best advantage. To avoid a feeling of confusion, do not crowd the

things exhibited. It is a better practice to present one or two items artistically and to change the display often. Teachers should observe the street windows and the interior display cases of first-class department stores for ideas to guide them in using their hall display cases (Figure 3-26).

3-26. A well-designed built-in display cabinet located in the main entry hall of a vocational school. (*Courtesy East New York Vocational School*)

References

Publications

1. Good, H. G., "The First Illustrated Schoolbooks," *Journal of Educational Research*, January 1942, p. 338.
2. Grossnickle, F. F., "Illustrations in Arithmetic Textbooks," *Elementary School Journal*, October 1946, p. 50.
3. Halbert, Marie G., "The Teaching Value of Illustrated Books," *American School Board Journal*, May 1944, p. 43.
4. Kambly, Paul E., "Science Textbook Illustrations," *Science Education*, February 1943, p. 17.
5. King, Lloyd W., "Changes to Be Expected in Materials, Organization, and Format of Textbooks." 14th Annual Conference for Administrative Officers of Private and Public Schools, University of Chicago Press, 1945, p. 9.
6. Modley, Rudolf, "Picture Books for Grownups," *Journal of Adult Education*, April 1939, p. 152.
7. Orth, Fred W., "Vitalizing the Textbook," *Progressive Education*, October 1936, p. 444.

8. Tuttle, Edward M., "Making Attractive Schoolbooks," *School Executive*, April 1936, p. 298.
9. Zisman, S. B., "Improving Illustrative Material in Textbooks," *Educational Screen*, September 1938, p. 219.
10. Department of Supervisors and Directors of Instruction. N. E. A. 1935: 8th Yearbook. *Materials of Instruction.*
11. Worrel, F. M., "Selecting the Right Type of Visual Aids," *Educational Screen*, XVII, December 1938, pp. 323-324.
12. Ream, Glen O., "Cartoons and the Chalk Talk in the Classroom," *Journal of the National Education Association*, XXIV, October 1935, p. 223.

Bulletin Boards—Blackboards

1. Beckley—Cardy Co., 1632 Indiana Avenue, Chicago, Illinois.
2. Luse Display Company, 129 So. Main Street, Akron, Ohio.
3. Multiplex Display Fixture Company, 910-920 N. 10th Street, St. Louis, Missouri.

CHAPTER IV

School Journey—A Visual Aid

The school journey is a teaching technique of long standing but it is not used to the extent it should be. If it is well organized, it is a transfer of the classroom to a museum, a factory, or a municipal department where the students may obtain first-hand contact with the subject being studied. The volume of knowledge is too great and the time too limited to taste, smell, feel, see, and hear everything, but it is possible to acquire a great store of information through observation. It is well to discuss in the classroom the skill and knowledge needed by a chemist or the operation of a blast furnace, but to see these things adds reality to the situation and objectivity to the learning.

The failure to use the school journey as a medium of learning is due probably to the inertia of teachers and the reluctance of supervising officers to encourage such an activity. Its educational possibilities must be recognized, and the old idea of schools within four walls must be eliminated. The thinking and attitudes of students can be better influenced by realities rather than by abstract discussions. There is no better way to introduce, to review, to clarify, and to give meaning to a subject than by a trip wherein the real thing may be observed.

It is true that trips of this kind tend to upset some of the school routines, but these interruptions will pay big dividends in terms of *student learning.* In every trip there is need for considerable planning since it should be a co-operative enterprise between the teacher and students with a definite purpose to be accomplished. It should not be an aimless jaunt but rather a supplement to class instruction, and consequently there should be an organized attempt to "look for things" not only to "look at things."

Preparation for the Journey

A school journey is successful to the extent that complete preparations for it have been made. The possibilities of a trip should be discussed with the students to develop an atmosphere of enthusiasm and anticipation. In all cases the proposed journey should be correlated with the school work thus removing it from the category of a picnic or an attempt to break the monotony of school attendance. When it has been decided to organize the journey, the students should participate and be advised on when, where, how, and what.

Teacher's Preparation

The resourceful teacher will conceive many school journeys that would prove profitable to the students. In the case of vocational teachers the skills and use of the tools of the trade are taught, but there remains a wide range of related information that students should learn. They should get this knowledge by personal contact. Therefore, teachers of electrical work, machine shop, and woodworking trades should arrange trips to such places as are indicated below.

Electrical

1. Power plant (steam)
2. Power plant (hydraulic)
3. Electrical supply concern
4. Motor manufacturing
5. Radio broadcasting
6. Electroplating

Machine Shop

1. Blast furnace
2. Foundry
3. Modern tool room
4. Inspection department
5. Gear cutting department
6. Automatic machine department

Woodworking

1. Modern lumber yard
2. Kiln drying plant
3. Furniture factory
4. Hardware supply concern
5. New building construction
6. Paint factory

After the place to visit has been decided upon, the teacher should contact the manager to determine the following:

1. Is a visit possible?
2. What day and hour are most convenient?
3. Is guide service provided?
4. Are there any special precautions to be given?
5. What is the approximate time necessary for the trip?
6. Is it possible to make the trip alone before the student visit?

Student Preparation

When this information is obtained and the instructor has made a preliminary visit, he is ready to plan the further details. The following suggestions are volunteered to prevent misunderstanding, inconvenience, and loss of time.

1. Distribute to each student a mimeographed memorandum carrying the following information:
   a. Place to be visited—full name of firm.
   b. Where the group will meet.
   c. The time of meeting.
   d. Means of transportation.
   e. Cost—transportation—food—fee.
   f. Special tools or notebooks to be used.
2. Develop a form for the signature of the parents whereby the student is granted permission to go on the journey and the instructor is released from liability for injury.
3. Develop with the students a list of things to be observed with the understanding that a discussion and quiz will follow the journey. These things should be discussed the day before the trip is taken and the list distributed *when the* students have *assembled* at the *meeting point.* The following outline is typical of what should be developed for all student journeys.

Student Guide

for a

Visit to a Modern Foundry

Location—450 S. Penn Street. Take No. 6 bus from terminal and get off at 28th Street, walk one block west.

Product—Turns out gray iron castings on jobbing basis. No high speed standardized production.

Raw Materials—1. Note the raw materials used.
2. What kind of fuel is used?
3. How is the raw material handled?

Cupola—1. What is its size and capacity?
2. How is the blast furnished—what pressure?
3. What was used in the "charge"?

Molding Floor—1. Observe how the flasks were made.
2. What is the difference between floor and pit molding?
3. See how the goggles and chaplets are used.
4. Watch how the venting is done.
5. How use is made of parting and facing sand.
6. Observe the care in drawing the patterns from molds.

Core Room—1. What is the mixture used to make cores?
2. Note the construction of core boxes.
3. Observe how cores are "rapped" out of boxes and baked.
4. What is the difference between wet sand and dry sand mold?

Pouring Metal—1. Observe the tapping of cupola and drawing of metal.
2. Note the safety precautions used by workers.
3. How is the slag removed from molten metal?
4. What special clothing do the workers wear?

Cleaning Floor—1. Why must castings be cleaned?
2. What is "snagging," "rattlers," "pickling"?
3. What is the advantage of buffing and sand blasting?

Summary—1. What is the most impressive phase of foundry practice?
2. Are molders skilled mechanics—are they well paid?
3. What improvement in the operations could you make?

Suggestions for a Successful Trip

a. Plan some observation or activity en route to keep the students busy.
b. Know exactly how to reach your destination, thereby not wasting time.
c. Keep up interest—do not let it lag.
d. Give the impression of leisurely handling the situation in lieu of appearing hasty and impatient.
e. Do not crowd too much into one trip.
f. Be sure to speak to each member of the group at least once during the trip.
g. Care should be exercised to plan every minute of the trip to avoid discipline problems.
h. Attempt to ask a question or point out something interesting to each member of the group.
i. Avoid using a whistle or clapping hands for attention.
j. Encourage the students to participate in discussion by asking questions; discourage a passive attitude.
k. Avoid "schoolish" attitude—permit students to relax.

Supplementary Instructions to Students

a. Avoid boisterousness on bus or trolley—remember a school is judged by its representatives.
b. Exercise all safety signs and precautions.
c. Do not tamper with machines, equipment, and materials.
d. Follow the instructor's directions.
e. Respect the property and rules of the management—otherwise trips may be discontinued.
f. Take complete notes to be used in discussion and writing of report.

Follow-up of Trip

The next day, or as soon as possible, discuss the trip.

1. Request students to present facts recorded in their notebooks.
2. Answer questions on doubtful points.
3. Show relationship to school work and value of information gained.

4. Develop a feeling of accomplishment and an attitude of appreciation for the opportunity.
5. Evaluate the whole experience by listing the benefits on the blackboard.
6. Explain that a letter of appreciation will be written to the manager of the plant for his co-operation and courtesy.

The progressive, interested teacher will arrange several trips of this type during the year despite any inconvenience the preparations will cause.

References

Atyee, H. C., *The Excursion as a Teaching Technique*, Bureau of Publications, Teachers College, Columbia University.

Brenholtz, R. A., "Visual Aids for the Woodworking Shop," *Industrial Arts and Vocational Education,* XXIX, March 1940, pp. 104-106.

CHAPTER V

Types of Visual Aids in Common Use

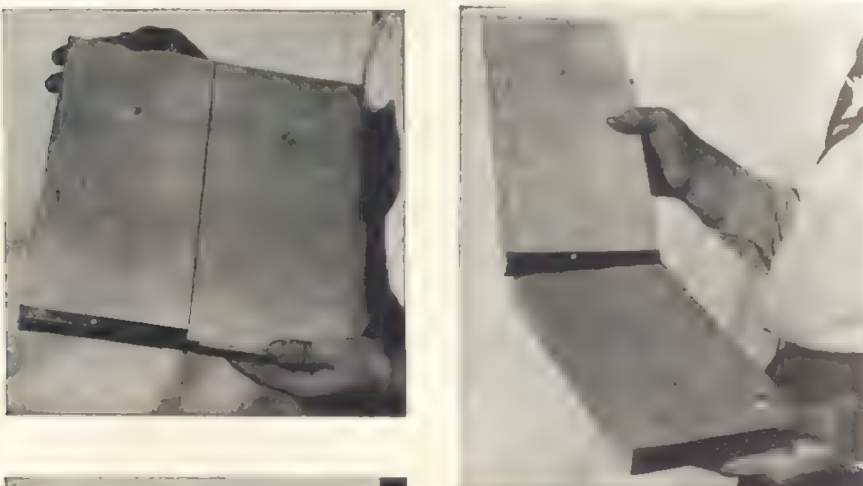
Visual aids vary widely in construction and application, but they are usually designed to render certain prearranged service. *The most effective and useful visual aids are those specifically designed to satisfy special needs.* The individual teacher is conscious of the difficulty in teaching a certain principle or theory, and consequently he feels the need for teaching aids to clarify his verbal explanations. The teaching aid developed under these conditions is usually a very effective one, as it is the result of a positive need based on experience. Usually the aid is developed to explain a principle or theory concerning mechanics, physics, chemistry, biology, and other forms of science. In every case the aid will do one of several things:

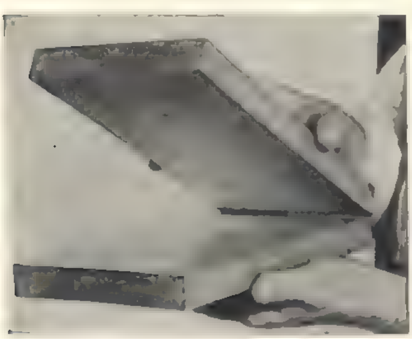
1. Explain an Abstract Idea or Principle

There are many abstract ideas or principles in most school subjects that need to be explained and clarified by means other than words. These "hard to understand" principles are usually made clear by the use of cleverly designed teaching aids. For example, the calculation of board feet is in this category. A board foot is defined as a unit of lumber measurement 12 inches long, 12 inches wide and 1 inch thick. Confusion occurs when it is stated that a board foot may be 24 inches long, 6 inches wide, and 1 inch thick, or it may be 12 inches long, 6 inches wide and 2 inches thick. This idea is clarified by the visual aid shown in Figure 5-1. It is so constructed that it is possible to manipulate it into the three forms indicated. This teaching aid makes clear in a few minutes that a board foot is a cubic measure and depends on the length, breadth, and thickness of the piece of lumber.

Another good example is that of the teacher of machine shop practice who had difficulty in teaching the meaning of "lead" of a screw thread and how it varies in a single, double, or triple thread. To clarify this instruction, a device shown in Figure 5-2 was con-

structed. The three screws have single, double, and triple threads, respectively. When the crank is turned, the nut on the double thread travels twice the distance of the nut on the single thread, and the nut on the triple thread travels three times the distance of the nut on the single thread. This simple device immediately clarified the understanding of "lead" of a screw thread on the part of the





5-1. Demonstration device to explain the meaning of a board-foot.

students. This is a typical case in which the teacher, confronted with a teaching situation that demanded assistance for his verbal explanations, devised a teaching aid to meet a recognized need.

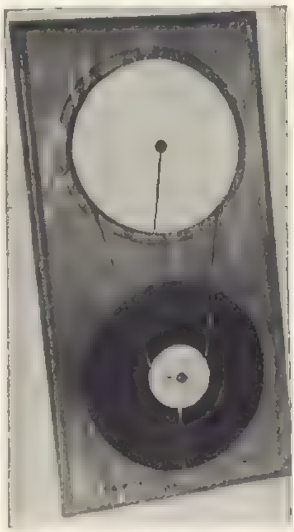
A further example may be the principle that pulley speeds depend on their diameters. The teacher may explain thoroughly this ratio of diameters to speeds, but no explanation is so convincing as a model or the real thing (Figure 5-3). It is a very simple device made of two sheave pulleys, in a 3 to 1 ratio, mounted on a board and

connected with an ordinary string or wire belt, which serves to simplify this matter of ratios and diameters.

2. Show Relationships

There are many situations when the relationship of things must be understood to appreciate the function of each part as well as the working of the whole unit or mechanism. Words are not sufficient to clarify the matter for the learner. Instructors continue to use words instead of models, charts, and the real thing to explain the

5-2. Device to clarify the meaning of pitch and lead of screw threads.



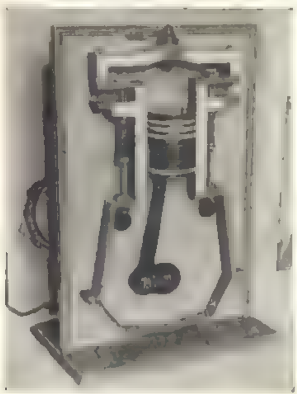
5-3. Objective teaching device showing relationship of diameters to speeds.

working of such mechanical objects. There are also situations where it is desirable to know the construction of a tool or object to permit the more intelligent use of the article. Again, words are not sufficient for a clear explanation and full understanding.

In all such cases, the instructor should devise suitable teaching aids. Although charts may be used in many cases, another form of visual aid for showing relationship is a section of the real object. The storage battery and the one-cylinder gas engine shown in Figures 5-4 and 5-5 are typical section models with the adjacent surfaces painted in contrasting colors to distinguish the different parts.

A very effective device was developed by a teacher of airplane engines who had difficulty in teaching the students the relationship between the rotary travel of the crank shaft throw and the reciprocating motion or linear piston travel in the cylinder. He pondered over the difficulty and consequently devised the visual aid shown in Figure 5-6 to simplify this learning difficulty of the students. This is a typical example of an effective learning aid devised by a teacher as a result of a recognized need for assistance to his verbal explanation.

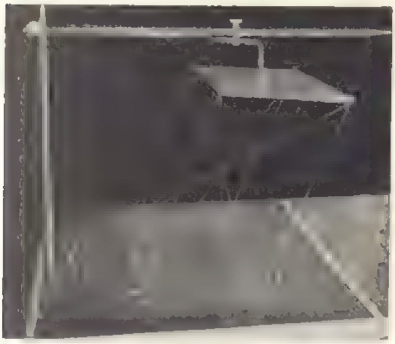
5-4. A sectional view of an automobile battery.



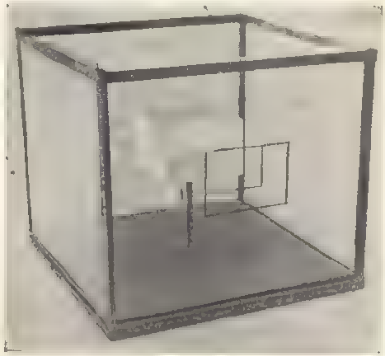
5-5. Working cross-sectional model of one-cylinder gas engine.

5-6. Model used to show relationship between crankshaft movement and piston travel

The various geometrical figures and solids used in geometry are not readily understood by students and consequently teachers have difficulty with their explanations unless they use some form of teaching aid. A very clever and useful device for this purpose is shown in Figure 5-7.[1]



5-7. Device to explain difficult geometric figures.



5-8. Projection case to show relationship of different views in orthographic projection.

Another situation demanding the understanding of relationships is in the field of mechanical drawing. It is difficult for students to grasp the idea of the three views necessary in practically all drawings. This difficulty can be clarified by the use of a projection case shown in Figure 5-8. The object to be drawn is placed inside the glass box and the respective views—top, plan, and side views—are drawn on the glass sides of the box. In lieu of glass, a fine wire mesh may be used. The wire has two advantages: first, it will not break and, second, chalk will show clearly on the wire. The teaching aid is very easy to construct and most effective in results.

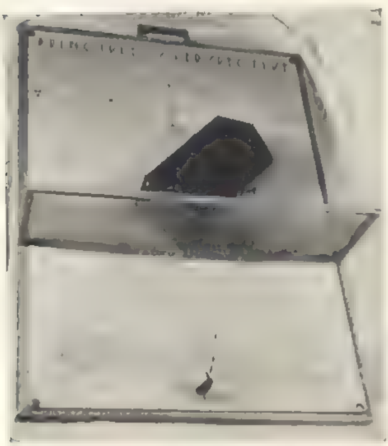
It is difficult to understand thoroughly the principle of mechanical perspective unless the relationship of parts is understood. A device shown in Figure 5-9 will assist greatly in the teaching of this principle and the subsequent understanding of the learner. The small house is constructed of cardboard with pieces of black and white string attached to each corner and converging at the station point. The points where the string penetrates the cellophane plane are connected, thus producing a perspective drawing of the house. Figure 5-10 is an example of an exploded display showing the rela-

[1] Patented, Floyd Armstead, Bremerton, Washington.

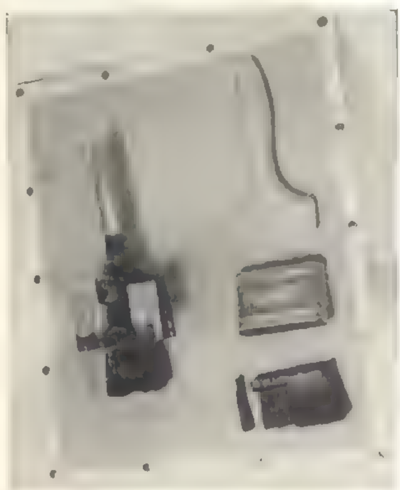
tionship of one part of the object to another. The use of this type of teaching aid is a great time saver. It avoids repeated explanations by the teacher and prevents the learner from formulating the wrong concept concerning the objects or device.

3. Show Sequence of Procedure

The successful learning of skills is dependent to a large degree on the sequence of the operations to be performed. Consequently, it is most desirable to impress upon the learner the order in which the



5-9. An aid to explain the principles of perspective.



5-10. Exploded display of a paint brush.

work must be done. It is the instructor's job to place before the learner examples of the work showing the successive steps to be taken. Each step should show the result of each operation performed.

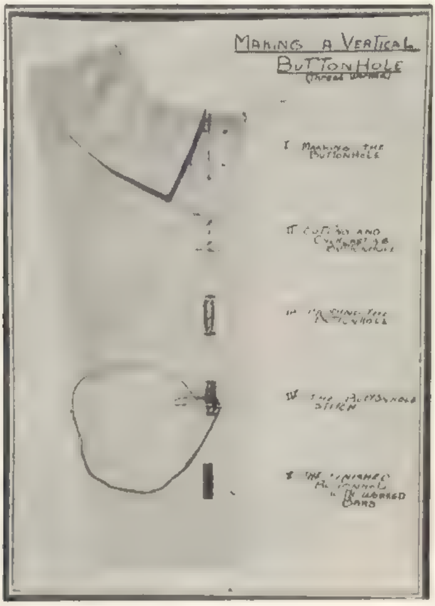
Figure 5-11 shows five stages in making a buttonhole. This type of aid is valuable for reference by the learners after the instructor has explained and demonstrated the necessity of the correct procedure.

Another example of a teaching aid showing the sequence of operations appears in Figure 5-12. This is a characteristic type used by commercial firms to explain how the product is manufactured. It is a most effective way of telling the story with a minimum of words.

The alert teacher of vocational subjects will use this form of teaching aid on many occasions.

4. Set Standards of Workmanship

An effective type of teaching aid to maintain high standards of workmanship is a well-made sample of the work to be done. This



5-11. Progressive steps in making a button hole.

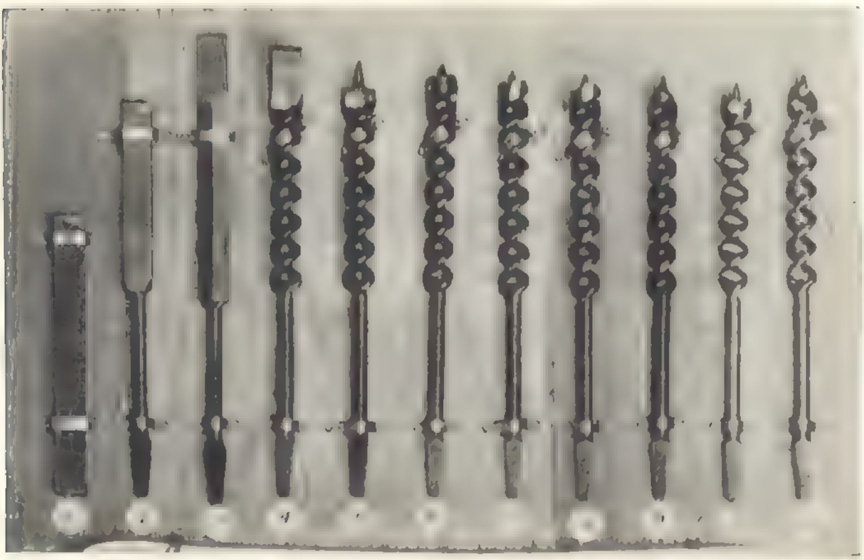
type usually consists of a display of the best student job produced in each successive group. It may consist of special samples made by the teacher; however, the former is more desirable as it provides a more feasible goal of attainment for other students. When students observe the accomplishments of their own schoolmates, they tend to emulate the work. This form of teaching aid not only sets standards of detailed workmanship but also shows the appearance of the completed project.

There is no limit to the use of this instrument of instruction. Practically all work of a tangible nature may serve as this type of

aid whether it be cabinetmaking, sheet metal work, dressmaking, millinery, etc. Teachers should make use of this incentive type of aid wherever possible (Figure 5-13 and 5-14).

5. Show Materials of Construction

Mechanics and learners will usually work more intelligently if they have some ideas concerning the physical, chemical, and working properties of the materials they handle in the production of usable articles. A dressmaker is a more effective worker if she has some knowledge of cotton, wool, and synthetic fibers. The machinist will work with greater understanding if he knows something about the production of iron and steel and the variations within each classifica-



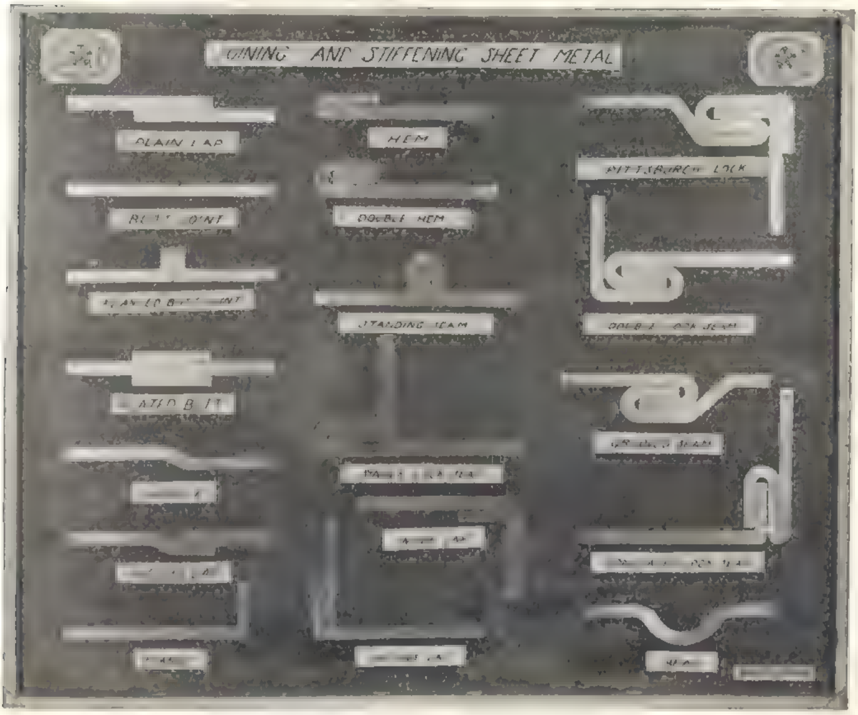
5-12. Sequence of operations in producing a commercial product. *1.* Steel Bar 2. Formed Shank and Shaft 3. Stock Flattened to Thickness *4.* Twisted Bit 5. Formed Head *6.* Finished Head *7.* Bit Turned to Size *8.* Scale Removed *9.* Cutting Edges Cleaned *10.* Scale Removed from Inside Twist *11.* Finished Product.

tion. The woodworker will enhance his effectiveness if he is familiar with various woods, their grain, strength, appearance, and reaction to working tools.

The progressive teacher will be on the alert for samples of raw materials used in his or her particular vocation, to be displayed at the opportune time in connection with special instruction. There

are commercial exhibits of this type available for the asking, but, the ambitious teacher will collect and arrange additional exhibits to supplement the free material (Figure 5-14A).

Despite the completeness and attractive arrangement of displays of this type they are ineffective because many times they are permitted to serve only as wall decorations instead of as media of instruction. They are on display constantly and consequently become



5-13. Display of sheet metal joints.

commonplace and go unnoticed. The efficient teacher will use such a display at times of real need and refer to them when the occasion demands but avoid using them only to break up the monotony of a blank wall.

6. Clarify by Enlargement

One of the most useful forms of teaching aids is the enlarged type. There are innumerable situations in which the object to be

explained is too small for group instruction. As a matter of economy of time and complete understanding the instructor should resort to an enlarged teaching aid. Many times an enlarged sketch or picture will serve the purpose while in other situations an enlarged model is necessary. This type of aid has two advantages: (1) it permits the showing of details, and (2) it enables the instructor to teach groups as well as individuals.

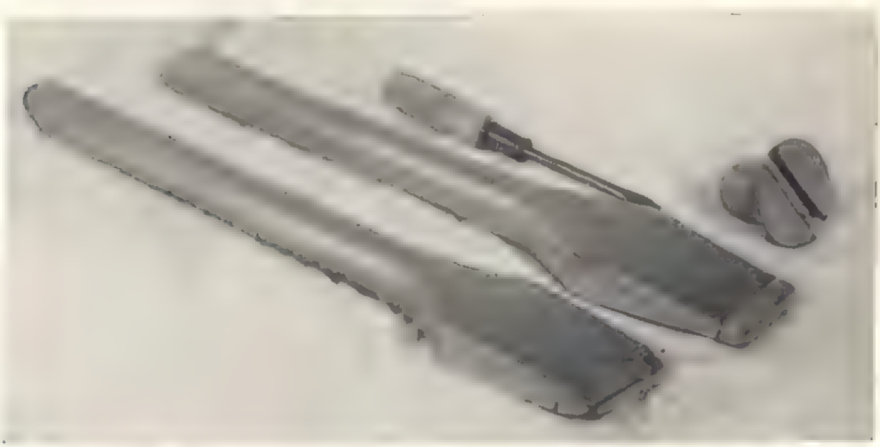
A very effective example of an enlarged aid is cited below to illustrate its value as a medium of instruction. The instructor has the

5-14. Examples of good workmanship

problem of teaching the proper grinding of a screwdriver to avoid two difficulties: "chewing" the slot in the screwhead, and the slipping of the screwdriver from the screwhead and piercing the worker's hand. The screwhead and the screwdriver blade are too small to be observed more than two feet away, thus preventing group instruction.

5-14a. Display of raw materials.

The difficulty in this situation may be overcome by the use of two wooden screwdriver models about 8 to 10 times the normal size and a screwhead to the same enlarged scale. By alternately fitting the correctly ground and incorrectly ground blade of the screwdriver into the slot of the enlarged screwhead, the learners are definitely impressed with the necessity of correct grinding (Figure 5-14B).

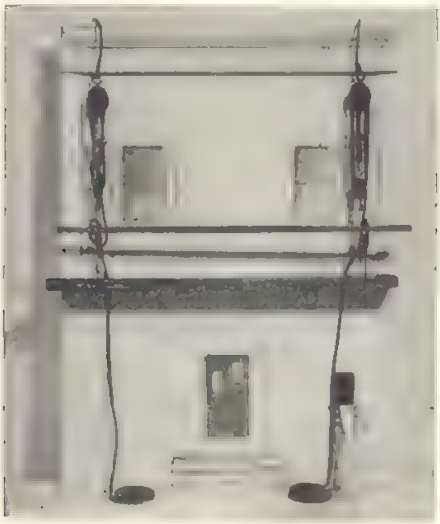


5-14b. Enlarged screwdriver for demonstrating proper sharpening.

7. Increase Understanding by Reduced Size

The reduced form of teaching aid is necessary for one of two reasons:

1. The object, machine, or equipment is too large to bring into the school.



5-15. Reduced teaching aid of painter's swing stage.

2. It is desirable for the learner to see the relationship of different parts, and to do so they must be concentrated in a relatively small area.

An example of this type is the painter's swing platform or scaffold (Figure 5-15). This structure is too large to bring into a school shop; nevertheless, certain preliminary instructions should be given to the apprentices before the actual use of such equipment. A greatly reduced working model, if constructed to scale, will enable the instructor to teach most effectively certain details concerning the handling of the scaffold. The placing of the roof hooks and the

handling of the rope can be practiced on the model without the hazards that endanger this trade.

It is evident from the examples given above that visual aids will definitely aid the learning process if they are carefully planned and intelligently used. Although the original planning and construction involve considerable time and thought, the instructor will find that such teaching aids pay big dividends in saving time and increasing student understanding.

Charts, Posters, and Cartoons

The discussion of most things in the mechanical and technical fields should be accompanied by supplementary explanatory charts. Words are not sufficient for clear understanding. The charts may vary in size, color, and type, but in all cases the purpose is the same —to enable learners thoroughly to comprehend the subject by understanding relationship of parts, functions of component parts, size and position of different parts, and "how it works" in general. Many charts are available through commercial companies and they range in value from poor to superior.

There are many situations wherein the instructor will have to devise his own charts to meet a specific need, and consequently it is well to learn something about the making of charts, as they should possess certain definite features. Much time and effort have been devoted to chart making by instructors only to find the results rather ineffective. The difficulties arise from the fact that certain basic rules were not followed in the construction. Detailed instruction for the making of charts will be given in a later chapter.

Charts may be classified as follows:

A. Data
B. Pictorial
C. Schematic
D. Diagrammatic
E. Animated
F. Phantom View
G. Folding
H. Graphic
I. Progress
J. Exploded View

Each of these types has a specific purpose for accomplishing certain definite ends. The charts are used in a large number of cases

where it is not possible to present the real object, or in cases where the objects are too large or too small for group instruction. In some cases, the chart is an enlargement and in other cases a reduction of the object shown. Each type is worthy of a detailed description.

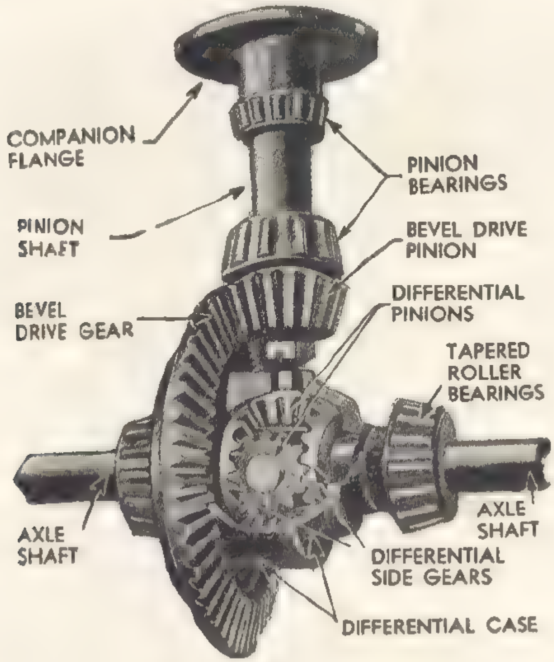
A. *Data Chart*—This form of chart is most common and covers a wide range of material. Manufacturers of various commodities have generously provided them for industrial and school use. They

5-16. Example of data chart.

cover such data as drill sizes, standard thread proportions, weights of materials, and hundreds of other items of information that are needed in vocational and technical education. The majority of schools have samples of this kind of chart although they may not have others. As a rule, the same data are available in handbooks, but the chart makes them more readily accessible. Figure 5-16 is a good example of a data chart.

B. *Pictorial Chart*—This type of chart varies greatly in form and

content. It may consist of enlarged photographs of machines, manufacturing processes, historical mechanisms, tool and machine identifications, garment and accessory styles and trends, X rays, and architectural details. In all cases, charts of this kind are a valuable supplement to the instructor's description and enable the students to form the correct visual images and learn the important parts of the machine under discussion. Figure 5-17 is typical of charts in this classification.

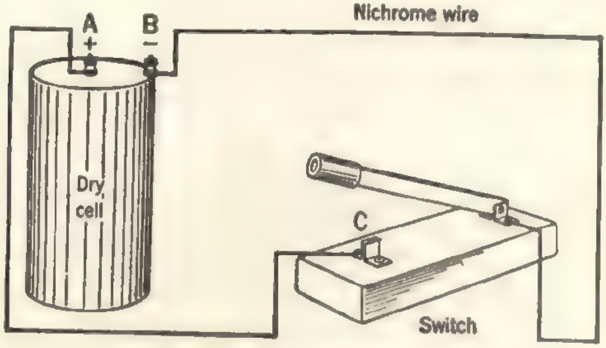


5-17. Pictorial chart.

C. Schematic Chart—This form of chart is particularly valuable in depicting how mechanisms operate that are actuated by electric, pneumatic, or hydraulic power such as acoustical controls, principles of optics, or water and heating systems (Figure 5-18).

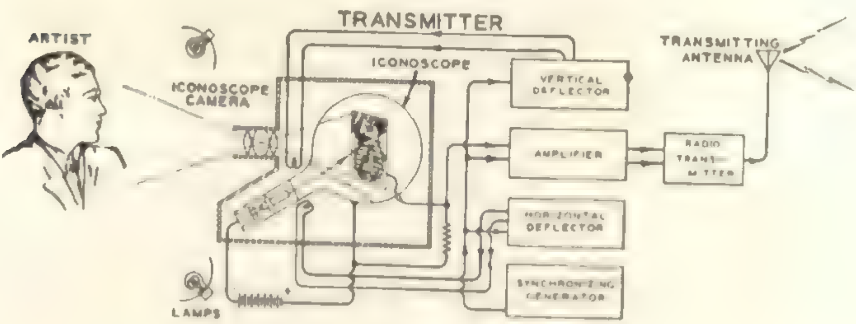
D. Diagrammatic Chart—This is an effective way of depicting the wiring diagrams, hydraulic lines, or pneumatic layout connected with a machine, job, or project. Symbols are used to represent meters, batteries, valves, pumps, and many other things. It is a very

convenient and economical way of presenting necessary information to engineers, installation workers, and operators of machinery and equipment (Figure 5-19). Instructors will find this type of chart a



5-18. Schematic chart.

very practical form of instructional material because the students will need to interpret this kind of information when employed as electricians, oil burner and refrigeration "trouble shooters," radio technicians, and workers in other maintenance jobs.

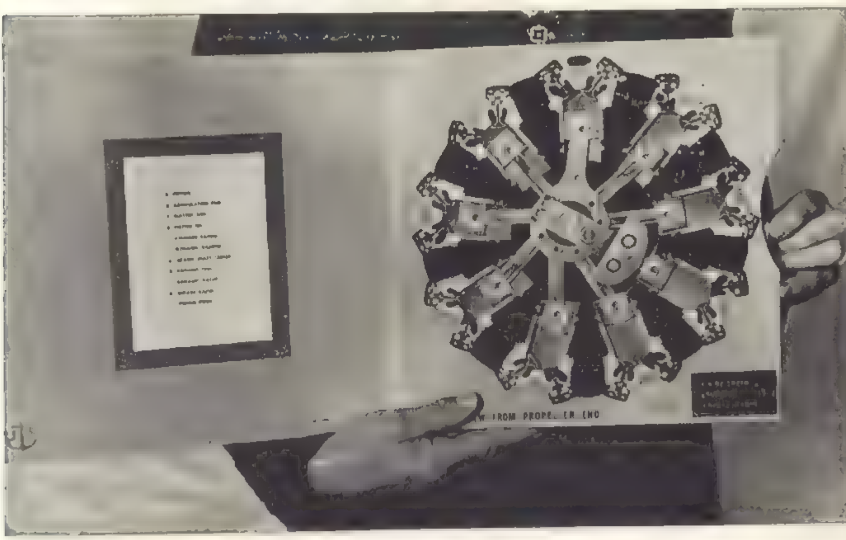


5-19. Diagrammatic chart.

E. Animated Chart—Charts in this classification are particularly valuable for instructional purposes because they not only create initial attention but also maintain interest over a considerable period of time. The animated chart has one or more moving parts that distinguish it from other charts and enhance its value as a teaching

tool. When it is desirable to show the line of travel of a part of a mechanism or indicate any change of conditions, the animated chart is to be preferred. Figure 5-20 is an example of this type. The pistons of the engine are actuated through the part held by the left hand of the demonstrator.

F. Phantom View Chart—This type of picture aids understanding because it shows interior or hidden parts without obliterating the outer shell or surfaces. In many situations this form of picture is to be preferred to a sectional view because it shows each part as it



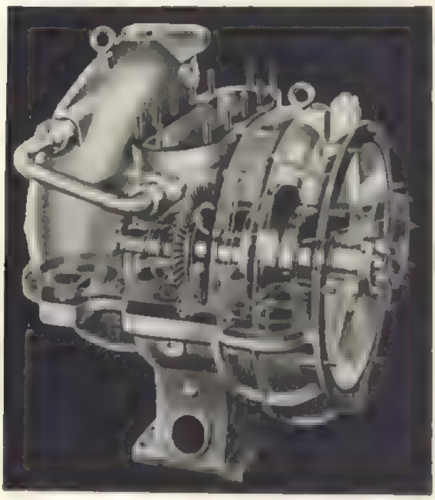
5-20. Animated chart.

actually exists. There is an increasing amount of this kind of illustrative material being produced by commercial concerns to explain the use and the functioning of their products (Figure 5-21).

G. Folding or Multiple Leaf Chart—The folding type of chart is most instructive and has found considerable favor with manufacturers of engines, motors, and other complicated machinery. It is a unique way of showing the internal working parts of a mechanism and at the same time confine the material to a compact form. Figure 5-22 shows a folding chart of an airplane propeller mechanism. The removal of the top sheet or acetate overlay shows how the mechanism looks with the housing removed. The removal of each succeeding sheet of acetate shows further internal views.

Although these illustrations are produced by commercial manufacturers, it is possible for the average teacher to develop this form of teaching aid without too much effort. It is a most effective way of showing the proper relationship of various parts of any mechanical device. Teachers should aim to secure every available commercial folding chart of this type that pertains to their work, if they wish to facilitate the learning of their students.

H. Graphic Chart—The graph type is an economical form of teaching device that should be more widely used in schools. Its chief advantage is the ease with which information may be imparted and comparisons and deductions. These charts are particularly valuable in the visualization of trends, comparisons, and relationships. It is a most economical way to provide data in a condensed form, covering such information as horsepower, output, electric consumption, engine efficiency, and an endless variety of data of every conceivable subject. The various forms of graphs must have all or some of the identification features shown in Figure 5-23 if they are to be intelligible. The adaptations of graphs in school work are limited only by the resourcefulness of teachers. There are many forms of graphs in general use, but for the average teacher it is sufficient to be familiar with the following types.



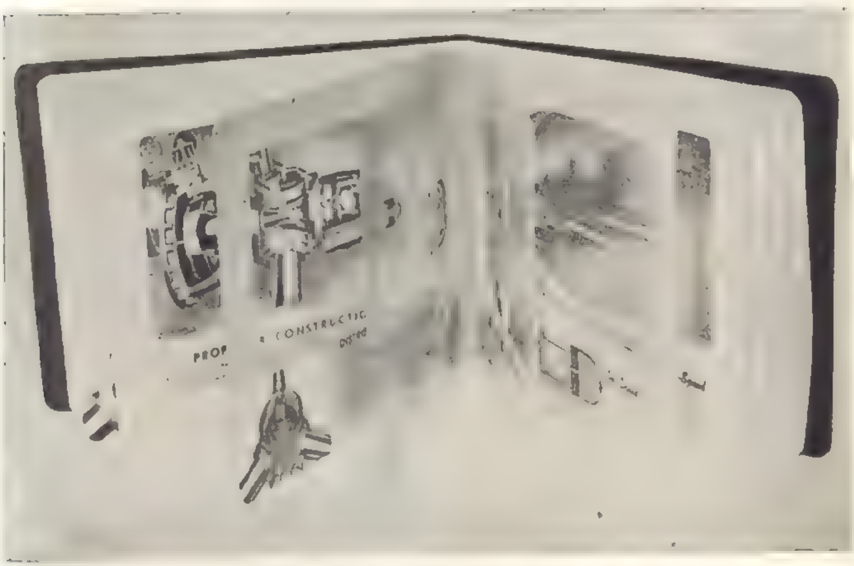
5-21. Phantom view chart.

1. *100% Bar Graph*—This is probably the most simple form of graph in which a bar represents 100% and parts of the bar represent percentages of the whole. Figure 5-24 is a bar graph showing the population of a community. The chief characteristics of this type are:

a. It may be in a horizontal as well as a vertical position.
b. The groupings may be indicated by brackets or percentages.

c. The sections may be cross-hatched or colored for identification.
d. A percentage scale outside the bar is of additional value.
e. The labels should read in a horizontal position.
f. It is easy to divide the bar into parts representing percentages.

2. *Multiple Bar Graph*—This is a variation of the single bar graph in which case multiple bars are used in lieu of sections of a simple bar. It has certain advantages when a series of facts are



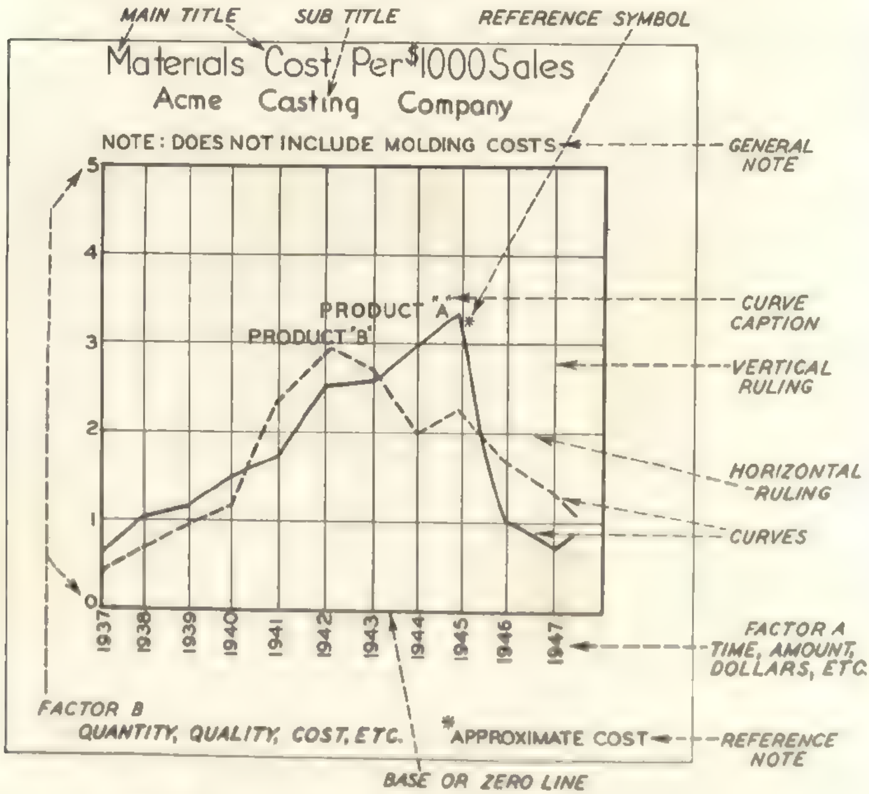
5-22. Multi-leaf chart of propeller mechanism.

presented. Figure 5-25 depicts the growth and decline of a boom town with a single war industry.

3. *Pictorial Bar Graphs*—In this graph symbols are used to designate specific values and are placed in a horizontal or vertical position. This form of graph is sometimes known as a pictograph or pictogram and is very popular for the presentation of factual information in the fields of publicity, education, and advertising. They are easily constructed with the use of a stencil of the symbol to be used. Many adaptations of the pictogram can be made in different school subjects. An example of this form of graph is shown in Figure 5-26.

It is sufficiently clear to need no explanation, as pictures are universally understood and have popular appeal, since, before the period of written language, man recorded his activities and accomplishments in stone carvings and paintings.

4. *Sector Graphs*—It is often advantageous to present data in the form of a circle in which the sector or pie chart is found convenient.



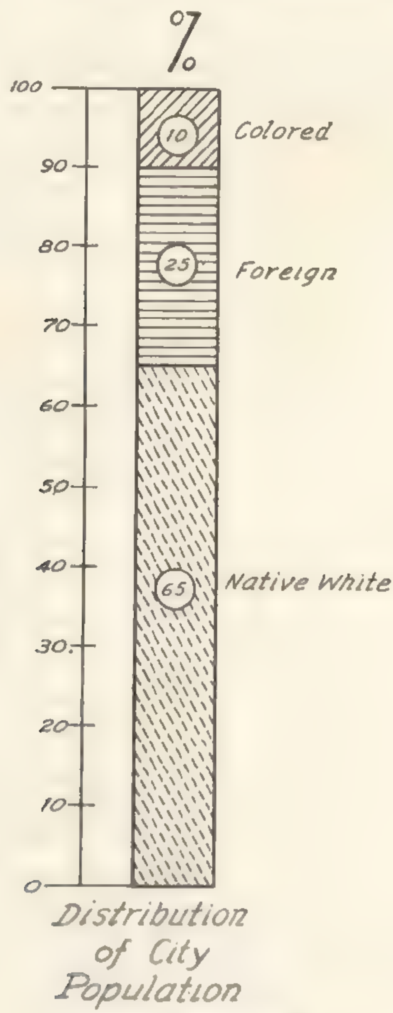
5-23. The variety of factors to be considered in drawing graphs.

The circle is divided into sectors along the radii. Each sector is proportional to the factual data presented and may be colored or cross-hatched to emphasize the different factors involved. The example shown in Figure 5-27 depicts the expenditure of an organization per dollar of income.

The picturization of expenditures is more meaningful and impressive than mere written figures. Material presented in a sector graph

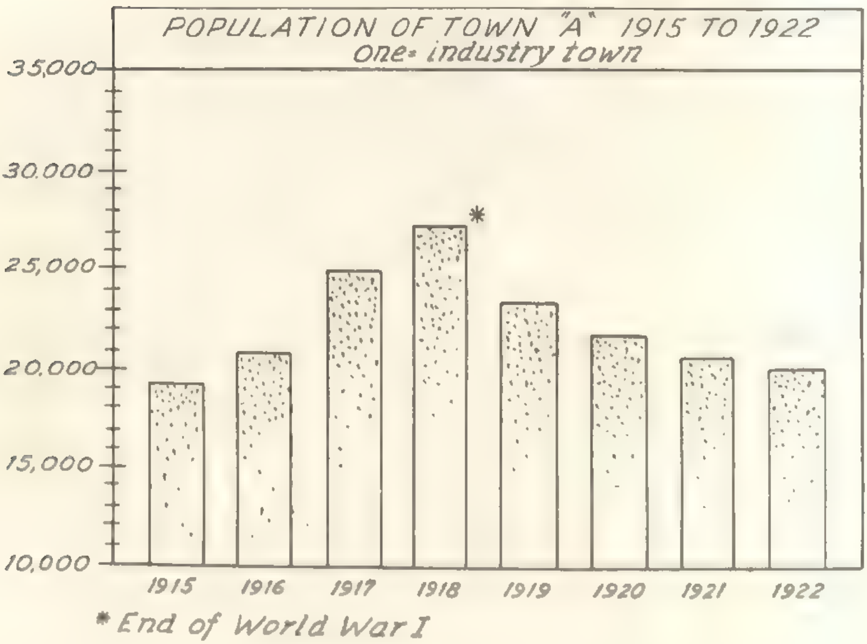
may be shown invariably by a bar graph, but sometimes the sector is more desirable for the specific purpose, which is the situation in the above illustration.

5. *Curve Graphs*—This is the most commonly used type of graph because of the ease of making. Various kinds of graph paper are available at the stationery store, which simplifies the work of plotting the data. This form of graph has several advantages.



5-24. 100% bar graph.

a. The variety of graph paper available makes possible the plotting of a wide range of quantitative information.
b. Several curves may be plotted on the same graph by simply changing the style of line from solid to dotted, or to dot and dash, or solid lines of different weights or colors.
c. A picture pasted on the graph will add to its attractiveness and assist in its interpretation.



5-25. Multiple bar graph.

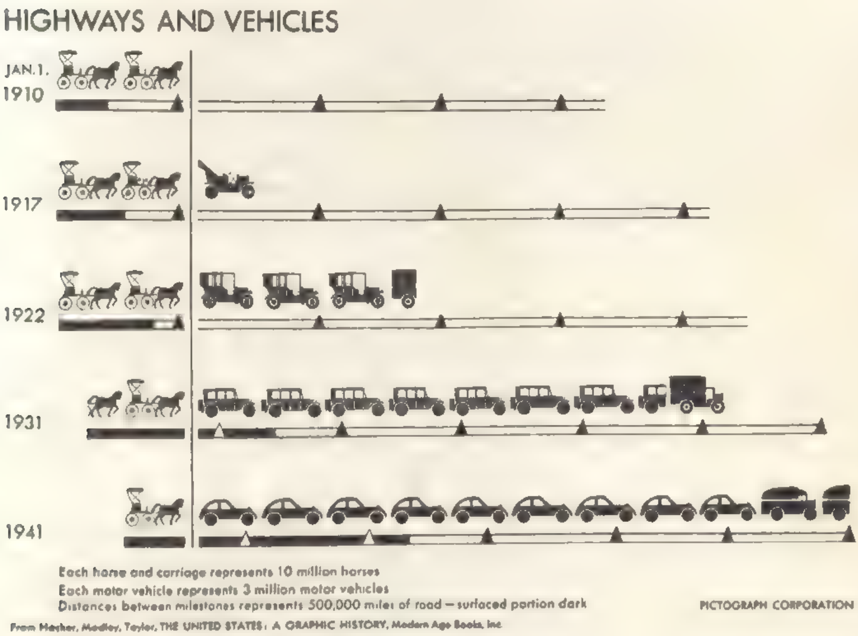
d. Two or more sets of data may be plotted on the same graph for comparative purposes.
e. The comparison of constants and variables is easily made.

The curve graph shown in Figure 5-28 incorporates the features enumerated above.

I. Progress Chart—This chart, as its name implies, indicates the progress being made by individuals, the completion of work in production, or the achievement in other situations about which information is wanted. A progress chart is very simple to construct, it

usually involves only two factors—"who" and "how much." It is a common form of record used in vocational schools to show the current progress of each boy or girl in shop work. It may be applied to all forms of student assignments, whether vocational or academic, in elementary or secondary schools or colleges.

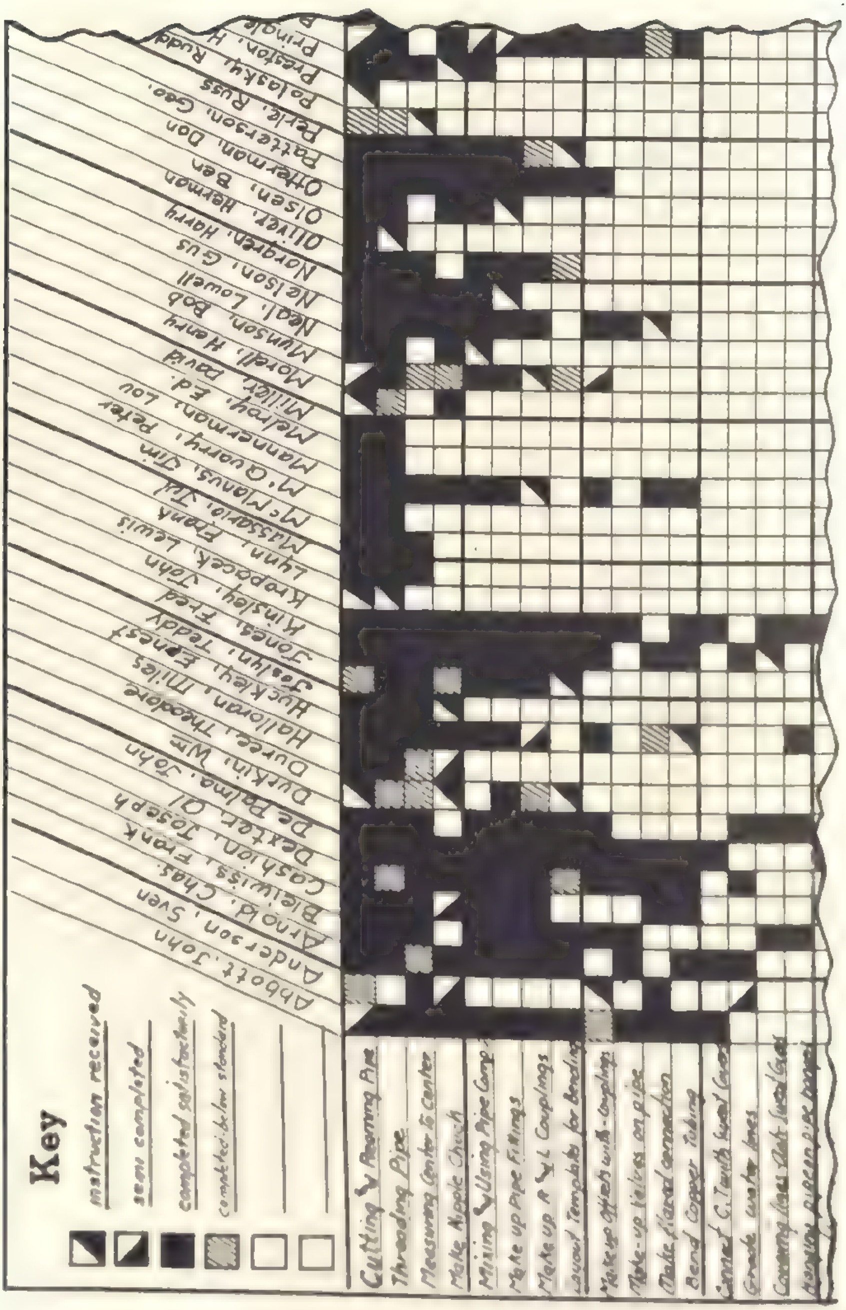
Figure 5-29 shows such a chart. When the boy completes a job or project, it is recorded on the chart in one of several ways. The



5-26. Pictorial bar graph.

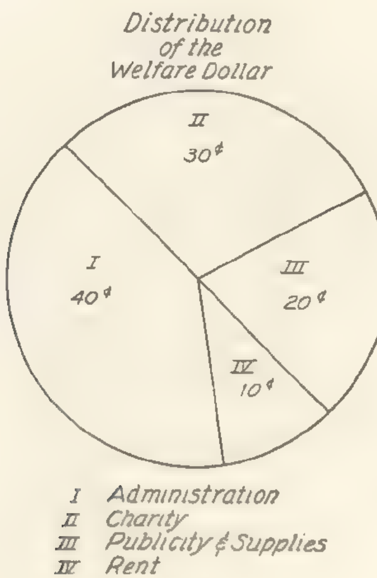
block opposite the student's name and under the job number is "filled in" by the instructor. It is possible to show not only the completion of work, but also the quality of student work by using colored crayon to represent different grades. Such a record tends to keep students busy as the work becomes a game, with everybody trying to make a good showing. Teachers find the progress chart a very essential feature of the vocational school record keeping.

J. Exploded Chart—This form of chart or drawing, although it is a form of pictorial chart, deserves a special classification. It has come into wide use during very recent times. It is particularly valu-



5-29. Progress chart.

able to the layman and average worker in the understanding of a complicated mechanism. It aids the layman in learning how the device functions and enables the factory worker to assemble the units in a minimum of time. The various parts are deployed in the sequence and extended position in which they exist when assembled. This form of picture drawing has replaced, in many situations, the detailed mechanical drawings and assembly views formerly used.



5-27. Sector graph.

It is to be expected that a chart of this kind will aid teaching and expedite learning. Manufacturers have been alert to its value and consequently are making use of it in handbooks and in manuals giving instructions and directions for the operation, adjustment, and repair of their products. Figure 5-30 not only shows a sample of this type of chart, but it also shows how the parts are set up for photographing.

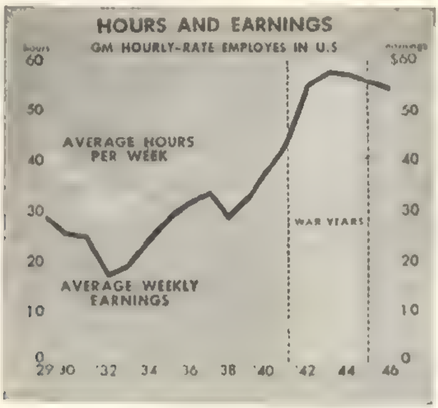
Posters

The poster is an effective means of "putting across" certain ideas such as safety, habits of workmanship, courtesy, and citizenship. If the posters are well designed, carry a single message, and utilize

attractive contrasting colors, they are excellent teaching aids. In every case, the poster should carry a snappy slogan or caption that will demand and hold attention; for example

STOP—THINK—BEWARE—

The lettering must be concentrated, bold and readable instead of fancy or "tricky." It is generally wise to avoid vertical or diagonal lines of lettering because of the difficulty of reading and consequent reduction in interest. The important feature of such a teaching aid should be a spot of bright color to emphasize a specific point or idea of interest.



5-28. Curve graph.

Figure 5-31 is a good example of an idea effectively presented which utilizes the important features mentioned in the foregoing paragraph.

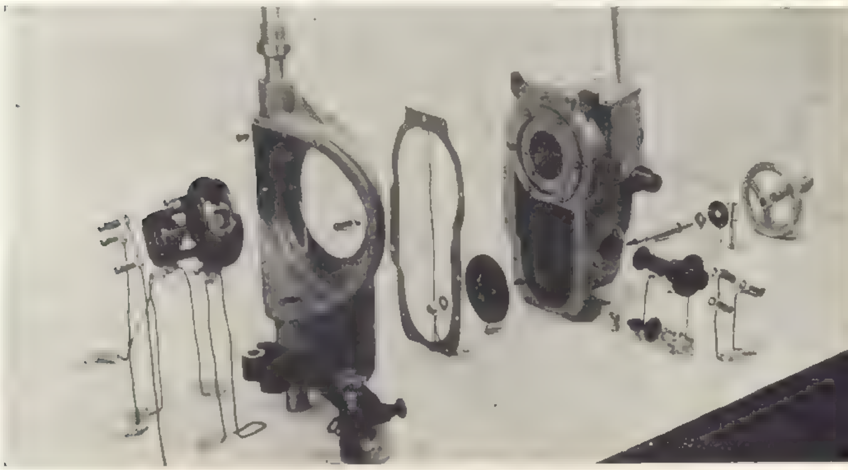
Cartoons

The cartoon is a terse and unique way of expression. It has been popularized by the daily newspapers and when used with discretion is a very potent instrument of instruction. It is especially valuable in developing proper work attitudes, cultivating correct habits of workmanship, and avoiding foolish and negligent mistakes that may cause waste of material and bodily injury. Some educators have shunned cartoons as low-brow and moronic, but they are most effective if we may accept the experience and recommendations of the

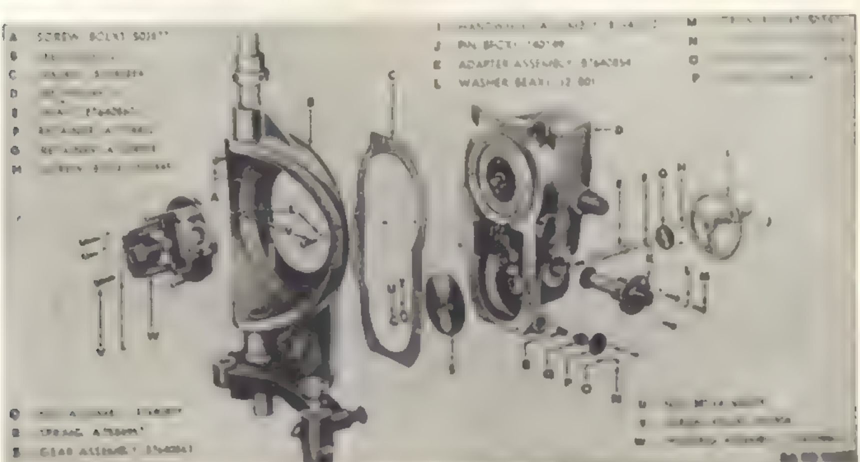
military officers who had charge of the war training program. Figure 5-32 shows in concise form the foolish habits of workmen that result in accidents.

Cartoons are particularly effective if they are finished in striking colors, displayed for a brief period, and then replaced by others that are equally attractive. It is a good plan to provide a new cartoon for each week to maintain the expectancy and continued interest of the students.

It is evident from the foregoing descriptions and illustrations that



5-30. An exploded chart and how it was photographed. (*Courtesy Jordanoff Corporation*)



a wide variety of visual aids exists. The subject to be taught, as well as the individual needs and resourcefulness of the instructor, will dictate the aids to be used.

Characteristics of a Good Visual Aid

It is appropriate at this point to indicate some of the most desirable characteristics of a *good visual aid* in order that these criteria may be recalled in designing, constructing, and evaluating teaching aids of various types.

5-31. Sign that demands attention.

1. It should explain an abstract idea, show a relationship, or present a sequence of procedure that cannot be clarified without it.
2. It should be large enough to be clearly visible to everybody in the group. An aid is not an aid if part of the class cannot see it.
3. The lettering should be large and bold to avoid eyestrain from any point in the classroom. Avoid decoration and prevent distraction.
4. The amount of lettering should be limited to terminology within the comprehension of the learner.
5. The important parts should be accentuated by the use of spots of bright color. This emphasis on the essential parts will enhance the value of the aid.
6. It should be made to scale, whether reduced or enlarged. The various parts should be in proper proportion, otherwise the learner may be confused.

7. It should be constructed of good materials if it is to stand constant usage in the classroom.
8. It should show evidence of good workmanship and be carefully finished in good taste.

5-32. Poster with a terse message.

9. It should be mounted in such a way as to make it portable, which will permit its use in more than one location.
10. Charts, drawings, and photographs should be properly protected with paint, shellac, glass, cellophane, or other protective materials.

5-33. A good safety poster.

When Using Visual Aids—Remember:

1. Have your aids *accessible* and in the proper order. Avoid *confusion.*
2. Keep aids out of sight until you are ready to use them. The greatest interest exists at the time of the initial showing.
3. *Use*—do *not merely show*—them. Know exactly what impression or information you wish to convey.
4. Display *one teaching aid at a time* in order to focus attention on the desired points. Sometimes it is necessary to display more than one chart to show similarities or contrasts.
5. Develop, when circumstances will permit, the *subect matter* of the aid *before* the *eyes* of the *student*. This procedure allows the teacher to present the material in the proper sequence and avoids misunderstanding.
6. *Supplement* the *chart* or other aid with *blackboard sketches*. This is sometimes necessary to clarify a certain point or to explain a detail before referring to the chart.
7. *Use them as aids;* they *do not* instruct in themselves.

References

Books

Arkin, H. and Colton, R. R., *Charts—How to Make and Use Them,* New York, Harper and Brothers, 1941.

Karsten, Karl G., *Charts and Graphs—Introduction to Graphic Methods in the Control and Analysis of Statistics,* New York, Prentice-Hall, 1923.

Modley, R. H., *How to Use Pictorial Statistics,* New York, Harper and Brothers, 1937.

Motion Picture

"Language of Graphs"—B & W or color (12 min.) Coronet Instructional Films, Coronet Bldg., Chicago 1, Illinois.

Blackboard

Arkin, Herbert and Colton, R. R., *Graphs: How to Make and Use Them,* New York, Harper and Brothers, 1936. 224 p. (revised in 1940).

CHAPTER VI

Novel Types of Teaching Aids

There are quite a number of specialized teaching aids that may not have been included under the classifications in the previous chapter. These additional types are very useful and should be utilized whenever possible. Invariably they are types of aids that may be developed by the individual teacher. This list may not be complete as new devices for instructional purposes are being devised continually.

The Flash Card

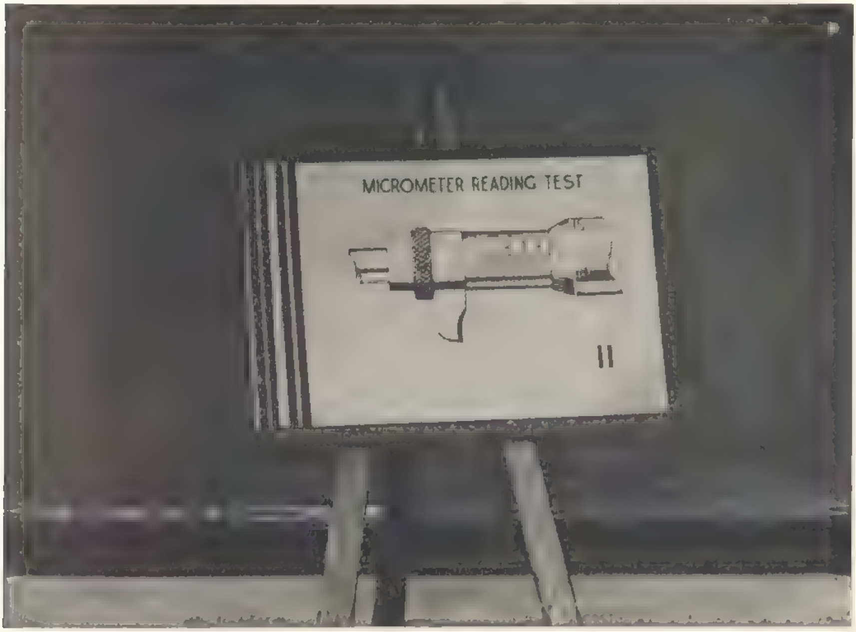
This idea is an old one and has been used by teachers in elementary education for many years. This technique is equally valuable in secondary education. The underlying purpose of its use is the stimulation of memory of factual knowledge and the recognition of objects. The Army devised a very expensive apparatus for the recognition of enemy airplanes that use the flash card idea. In this case, the flash cards were small, 2″ x 2″ slides carrying the picture of airplanes. These pictures were flashed on a screen at controlled intervals. The score of the learner was based on the number of airplanes he could correctly identify within a specified time.

There are many applications to be made of this idea in vocational education. This is a most helpful teaching aid in such cases as learning nail and screw sizes, tap and drill sizes, micrometer readings, vernier caliper readings, electrical symbols, and many other items. Examples of flash cards are shown in Figure 6-1.

Electric Questioner

This idea was first used in connection with an educational toy, but it has been adapted, for use as a teaching aid. It has somewhat the same advantages as the flash card but has the added feature of showing the learner when he is correct. The individual can work by himself and get the sensation of playing a game.

Figure 6-2 shows such a questioner used to learn the names of various parts of an engine lathe. The pictures of the parts are mounted on the large cards and slipped into the card holders while the names of the parts are inserted in small card holders arranged in a vertical column on the right. On the back of the board will be found wires connecting each of the large card holders to the corresponding small card holder carrying the correct name of the part.



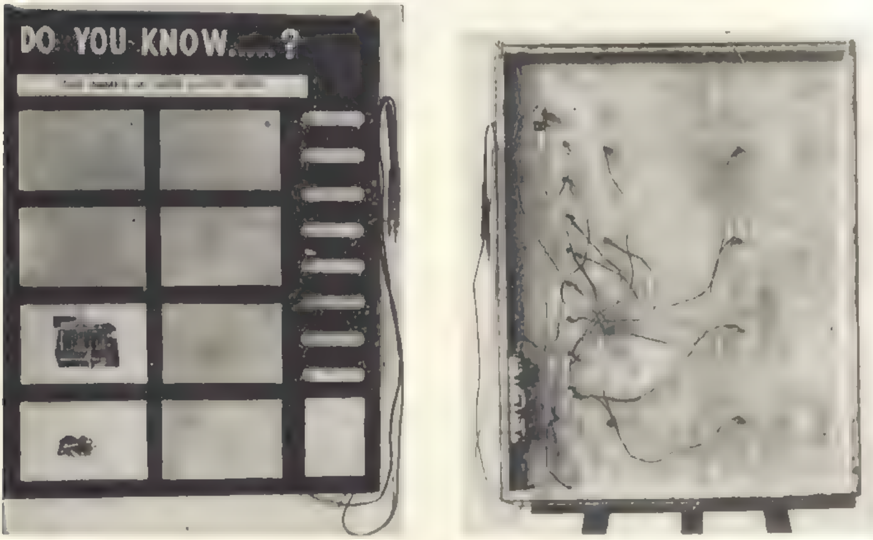
6-1. Flash cards of micrometer readings.

Also on the back of the board are two small dry batteries wired to the bull's eye located in the upper right-hand corner and the two terminals shown in front of the board at the bottom. If the cards have been properly placed in the holders the bull's eye will flash when the two terminals are placed in contact with the corresponding pair of card holders carrying the name and picture respectively.

The board may be made to carry any desirable number of card holders. When different subject matter is used a new caption should replace the one shown, "The Names of These Lathe Parts." The question may be raised that students will remember the positions of the corresponding holders that cause the bull's eye to flash. This

difficulty may be easily overcome by changing the wires attached to the large card holders when new subject matter is used. One screw on each card holder acts as a binding post for the wire. When the knurled nut on the binding post is released, the wire may be removed and transferred to some other card holder and thereby change the "set-up" for the new series of subject matter cards.

It is readily understood that such a device has many uses. It may be used for individual or group instruction. A large one could



6-2. Front and rear views of an electric questioner.

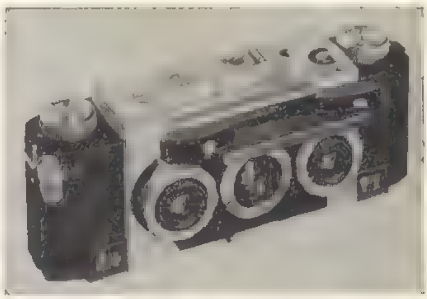
be constructed for teaching chemical symbols, decimal equivalents of an inch, mechanical drawing symbols, etc. In this case, the two terminals could be the regular blackboard pointers properly wired with metallic ends. In group work, the instructor will be assisted by two students who will handle the metal-tipped pointers. When the teacher names a chemical element, the student will place the metal end of the pointer on the card holder carrying the name of the element. The other student will be asked to select from the list of chemical symbols the one representing this particular element. If the correct card holders have been contacted by the two metal-tipped pointers, the bull's eye will flash.

The Stereoscope

There is a consensus supported by fairly reliable data that the stereoscope is a superior type of static visual aid. The perspective or stereoscopic effect in a picture, other factors being the same, increases the observation perceptibly. It creates an illusion of depth, perspective, and distance. A very satisfactory type of stereoscope is shown in Figure 6-3.

It is an inexpensive device and is highly recommended for use, provided the pictures are available in the subjects desired. The

6-3. Good type of stereoscope. (*Courtesy Keystone View Company*)



6-4. Camera for taking stereoscopic pictures. (*Courtesy of David White, Milwaukee.*)

Keystone View Company of Meadville, Pennsylvania has a large selection of pictures within certain restricted fields. It is possible, however, for the teacher to make his own stereoscopic pictures.

The stereoscope picture is produced by a camera with two lenses or with a single-lens camera mounted on a tripod with a device that allows the camera to be moved an exact distance, right or left, without changing the focus. The distance the camera is moved after the first picture is taken is equal to the average distance between the human eyes and is referred to as the parallax.

The use of the two-lens camera is often the better procedure as it produces two pictures simultaneously that are an exact replica of the images produced on the retinas of the eyes (Figure 6-4). The stere-

oscope is in reality an optical instrument and blends the two pictures with the same satisfactory result as the nerve mechanism of the eye.

This teaching aid is definitely better for individual instruction. It excludes all outside distractions to the point that the student is oblivious of the presence of the teacher and what he or she is saying. This pseudo-isolation has a wholesome effect as the student is inclined to imagine himself a part of the pictured situation. This intimacy has a stimulating value from the standpoint of learning, in the

6-5. Display of broken tools—the result of improper use.

6-6. Display showing effects of unsafe practices.

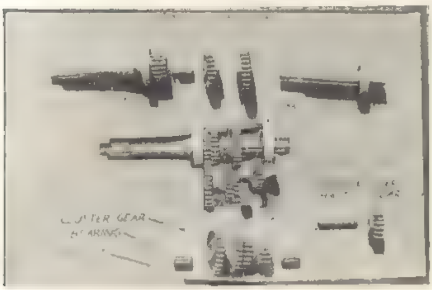
way of giving original thought to the thing he is viewing. There is, furthermore, evidence that the stereoscope has a somewhat greater value with duller students as they are limited in the use of abstract thinking. It is particularly valuable to the individual when studying the molecular structure of metals or other materials, bacteria, the effects of compression, tension and torsional forces on materials, and in other situations where depth perception is necessary for understanding.

The teaching devices described in this chapter are the indispensable teaching tools of progressive teachers. It should be the constant aim of vocational teachers to devise and construct such teaching devices as will aid student learning.

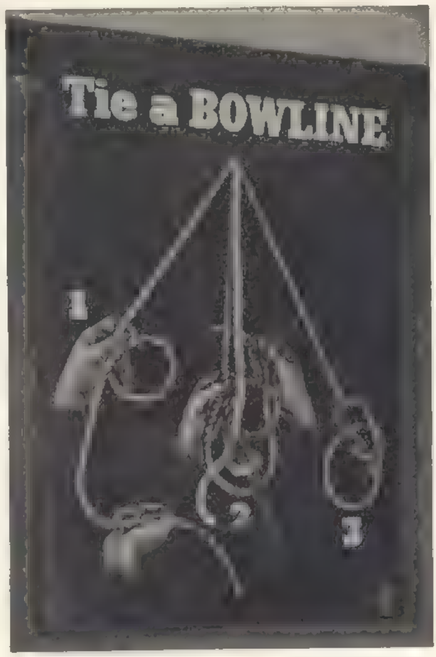
Display Boards

This form of teaching aid is most useful in vocational and technical education. They vary in type with different objectives.

1. *The care and use of tools* may be effectively taught by mounting on a display board tools that are broken as a result of improper use (Figure 6-5).
2. *Safe practices* may be emphasized by a dramatic display of the results of using unsafe equipment or following unsafe work procedures (Figure 6-6).



6-7. Working display of automobile transmission.

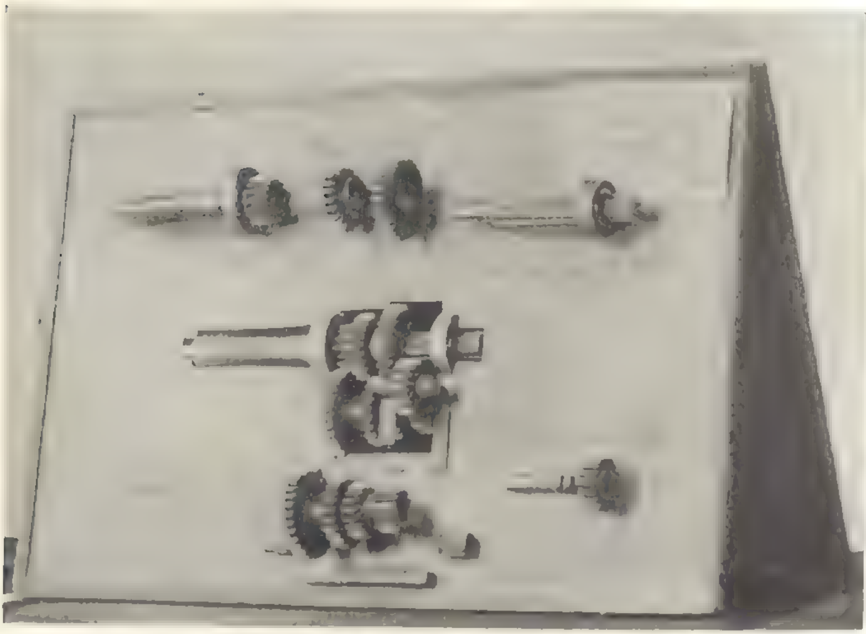


6-8. Chart that combines "doing" with "seeing."

3. *Certain mechanisms*, such as auto brakes and transmission gears, may be mounted on display boards in a manner to permit manual operation. This arrangement allows the learner to gain an understanding of their operation and function prior to working on a "live car" (Figure 6-7).
4. A very clever type of display board is one that combines the "doing" with the display. Figure 6-8 shows a large chart depicting the proper type of a bowline knot. In this case the procedure is pictured, but, in addition, a piece of rope is at-

tached to the display board and permits the learner to perform the successive steps by following the picture. This same idea may be utilized in many other situations.

5. *The relationship of parts* may be thoroughly understood by mounting the co-ordinate parts of a mechanism on a display board with each piece placed in its exact relationship to adjacent parts. This kind of display is known as the exploded type (Figure 6-9).



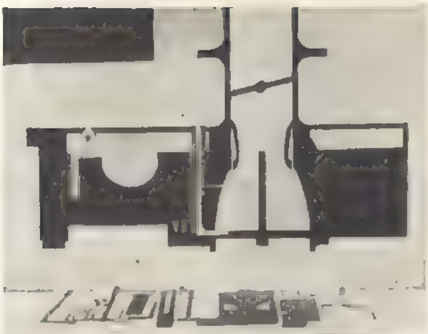
6-9. Display board to show realtionship of co-ordinate parts.

6. *The explanation of a principle* may be effectively taught by the use of a display board which is developed as the lesson progresses. Figure 6-10 shows the skeleton of a carburetor painted on a board background. The various parts shown in the foreground are made of sheet metal and are hung on nails in the proper position as the need arises in the development of the lesson on the operation of a carburetor. This is a unique method of presentation.

7. A *materials display* board may be considered as a learning aid for students rather than a teaching aid for teachers. It con-

sists of samples of articles used in a particular trade. In a woodworking shop it may be composed of the types of building hardware. In a machine shop it may include the various types of screws, bolts, and nuts used in the metal trades (Figure 6-11).

The different items are usually identified by a number which refers to a list on the side or rear of the board where the correct names are indicated. The students, by constant



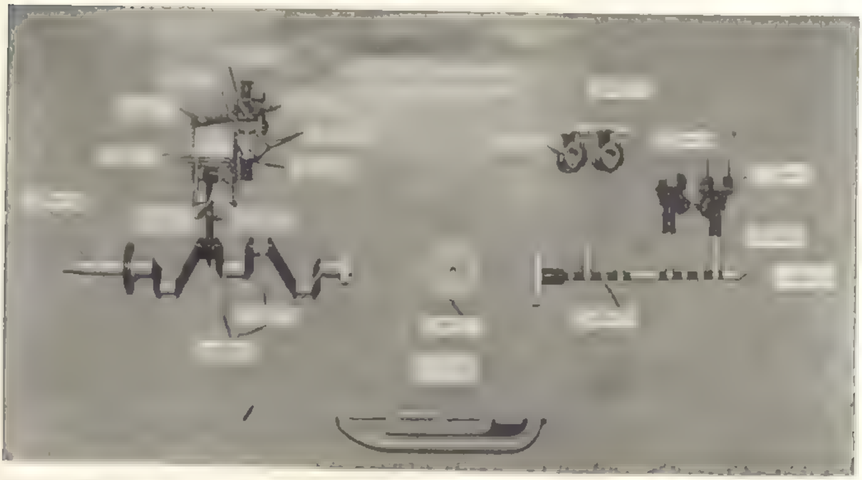
6-10. Display board teaching aid that is developed as the instruction progresses.

6-11. A good example of a materials display.

reference to a display of this type, soon learn the correct names of the items and, in addition, develop an interest in their sizes, styles, and uses. It is a fine example of unconscious learning on the part of students and therefore recommends itself for use.

8. *Name and function of parts.* Figure 6-12 shows another display board with the actual units or subassembly mounted on the board. A red ribbon connects each part with a card on which the name is printed. This is not only an attractive type of visual aid, but a valuable one to create interest and to learn the names of the parts.

9. The display board shown in Figure 6-13 is made of magnetized metal. It is very useful to explain the location or formation of a series of objects. The different objects used or displayed must be made of relatively light metal. When they come in contact with the board, they will remain where placed. The board shown was used to teach novices the position of ships in a convoy. This type of teaching aid can be of great assistance to a resourceful teacher.



6-12. Effective display board showing the parts and names of a 4-cylinder aircraft engine.

10. Figure 6-14 shows a combination schematic chart, display board, and working model of a five-tube ac-dc broadcast superheterodyne radio. In this case the electrical circuits are painted on the front of the board and various parts of the complete unit are mounted at the proper places. The whole device is properly wired and connected to permit the proper functions of the integral parts. This teaching aid is most valuable as it shows the interrelation of all the parts and permits a complete demonstration because it is also a working model.

Motion Boards

Although the motion board could be grouped with other forms of display boards, it is worthy of a separate classification. Its name implies its construction and purpose, which is the explanation of me-

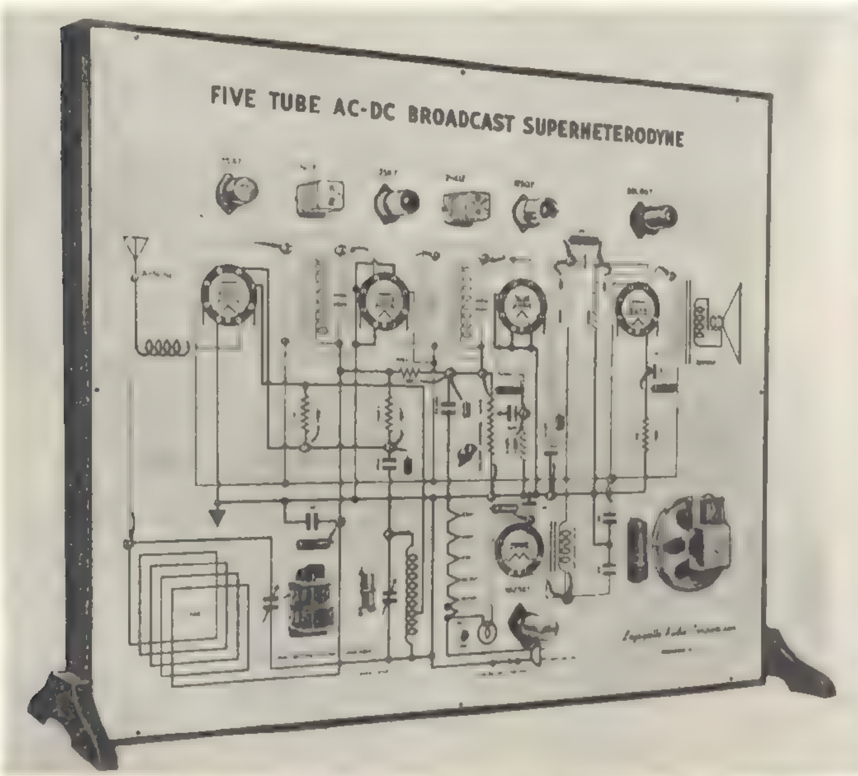
chanical movements. In the teaching of related science it is necessary to show working examples of certain types of motion, such as rotary, reciprocal, and intermittent, through the use of gears, levers, cams and other mechanisms. The motion board proves to be a very effective teaching aid. See figure 2-4, p. 22.

Although these various kinds of mechanical movements are to be found in innumerable machines and devices, it may not be convenient to bring them to the classroom or teaching laboratory because of

6-13. Magnetic display board for use in teaching the formation of ships in a convoy.

size or inaccessibility. The motion board, however, may be constructed by the average teacher in every vocational school. The necessary parts can be made in the school, as they serve as a good medium of shop instruction. Figure 6-15 is an example of one of these boards. The power is provided by a 1/20 h.p. a-c motor. In this particular case the transmission of power is demonstrated by the use of pulleys, bevel gears, and spur gears. The ratio of speeds may be explained also by the r.p.m. and the peripheral speed of the operating parts.

Figure 6-16 shows additional units for the explanation of the action of spiral gears, cams, and eccentrics. The units may be connected with the source of power by being placed in the proper position as the first unit (Figure 6-15).



6-14. Combination schematic chart and display board of a radio set. (*Courtesy of Lafayette Radio Corporation*)

Models

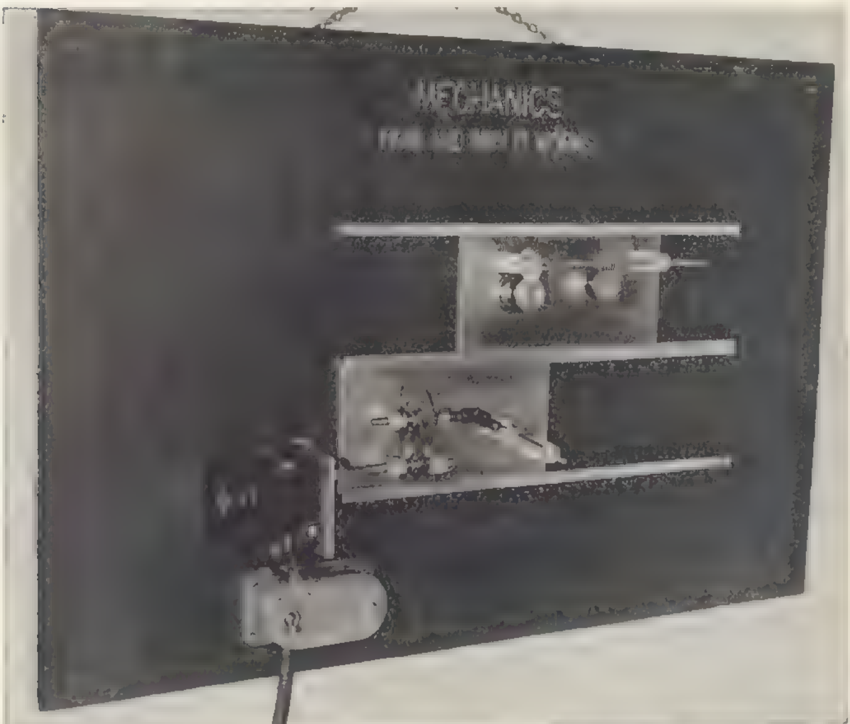
Some people feel that models, particularly working models, are the most effective form of teaching aid. In this case, the student not only can see it but he can touch it, examine it closely and operate it, and meanwhile the instructor can save a great deal of time and effort. It makes both learning and teaching easier.

Models vary greatly in form, depending on the purpose for which they are designed. In one case a simple enlargement of the original

object will be adequate for the purpose, while in other situations, an elaborate working model may be required. It must be remembered that any teaching aid must be justified on the basis that it aids learning. The following classification of models will serve the purpose of this discussion:

1. *The Cut-out or Cross-sectional Model*

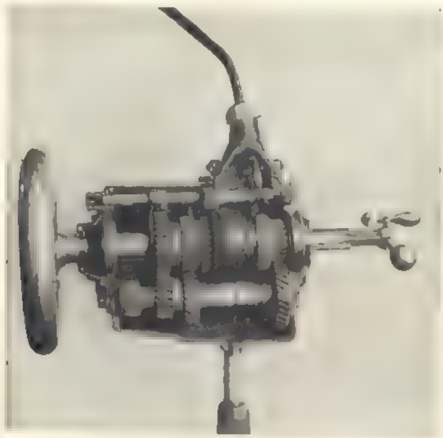
There are many situations in vocational training where it is necessary to see the interior of a piece of equipment or machine to under-



6-15. Mechanical motion board showing different mechanical movements.

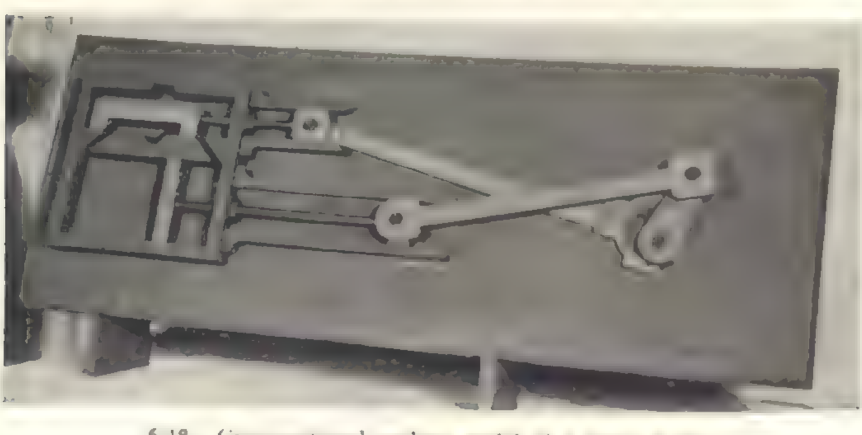
6-16. Additional units to be used with the mechanical motion board.

stand "how it works." It is necessary, therefore, to cut out or section the object at the proper place to show to the best advantage the important features of the device. Figure 6-17 shows a sectional model of an automobile transmission illustrating the function and relation-



6-17. Cross-sectional model of an automobile transmission.

ship of the various parts. The wooden cross-sectional working model (Figure 6-18) shows the relationship between the piston and valve section of a steam engine. The teachers of shop work and drawing should utilize this form of teaching aid on an extensive scale as it is fundamental to understanding any device or mechanism.



6-18. Cross-sectional working model of a steam engine.

2. *Working Model*

This form of teaching device is the most effective because it "shows how it works." The experienced person may understand the operation of a mechanical device as the result of a reasonably good explanation but the student or novice must be shown. Working models may range from simple to very intricate, but in all cases they are most valuable to help teaching and clarify understanding.

6-19. Wooden model of shaper reversing mechanism.

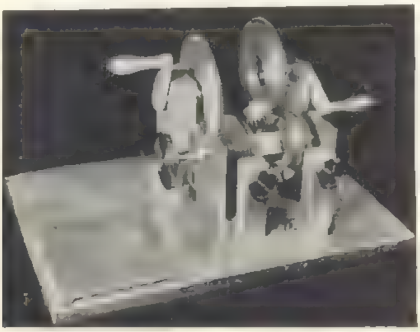
6-20. Reduced model of elevator. (*Courtesy of Otis Elevator Company.*)

Some working models are exact reductions of the original, although it may not always be made of the same materials. The punch press explained under "reduced models" is also a good example of reduced "working model."

On the other hand the model may vary in size and appearance from the original but still involve the principle of operation. This type is shown in Figure 6-19, a working model of the mechanism which controls the length of the shaper ram stroke.

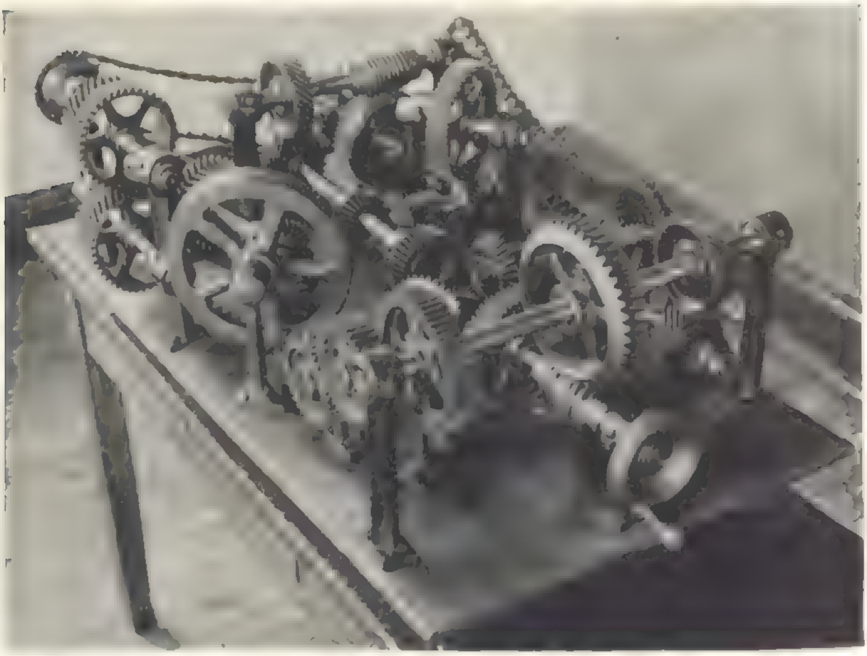
This form of teaching aid is needed in a great many teaching situations in lieu of verbal explanations which permit too many wrong

impressions. Figure 6-20 shows the front view of an elevator model designed by the Otis Elevator Company. It is used to train elevator maintenance men. The model is built to scale with sufficient acces-



6-21. Model mechanism to explain the working of an automobile differential.

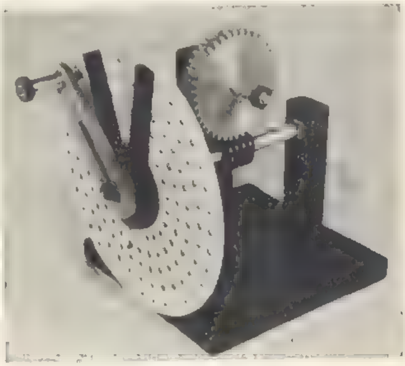
sories to simulate the troubles that occur in a full-sized job. It has been found to be most valuable in teaching the fundamental electrical knowledge that controls the proper functioning of an elevator.



6-22. Working model showing the transmission of motion by various types of gears.

Figure 6-21 shows a model of an automobile differential which is rarely understood. This working model makes it possible to explain clearly and in a brief period why the one wheel of an automobile may turn more slowly than the other wheel while going around a curve.

A variation of the motion board is the working model shown in Figure 6-22. This is an ingenious device showing the adaptation of various types of gears for the transmission of power. It is most useful in the teaching of machine shop practice as well as related science.



6-24. Wood and metal working model of a milling machine dividing head.

6-23. Enlarged model of an automobile distributor.

Instead of the hand wheel for operation, a pulley and small motor could be used.

The aid shown in Figure 6-23 is very useful to a teacher of automotive work. It is an enlarged distributor. Where formerly one or two students could be taught with a regular distributor, it is possible to teach a class of 16 to 20, which is sufficient justification and compensation for the time spent in building this device.

Another very useful working model is one of a milling machine dividing head (Figure 6-24). The young learner invariably must accept on faith the principle on which the dividing head operates. This visual aid permits one to observe the internal workings of this device and makes an indelible impression of the gear ratio which forms the basis of its usefulness.

3. *Enlarged Model*

When group teaching involves the demonstration or explanation of a relatively small object or device, the great difficulty is the inability of the students to see the object plainly. To overcome the difficulty, teachers invariably hold the object up to the view of a few students at a time. This procedure often interrupts the attention of the class as a whole and creates an undesirable situation.

6-25. Enlarged model of linotype matrix with actual matrix showing contrast in size.

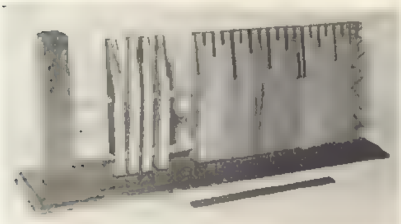
6-26. An enlarged model of a lathe tool with removable pieces.

The instructor in such instances will find that an enlarged model is the only effective way of solving the problem. Not only is the progress of the demonstration or lesson unimpeded by employing the aid, but also the instructor can explain the object or mechanism with better assurance that every student is following each point discussed.

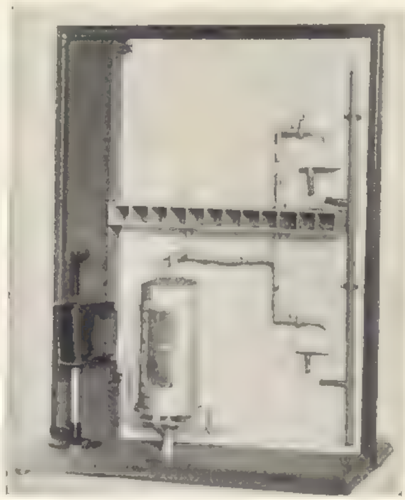
A good but simple example of a need for an enlarged model is a piece of type or the matrix of a linotype machine. In both cases the thing itself is too small to be used for group instruction, while the enlargement enables the students to observe the various parts as the teacher explains their function (Figure 6-25). Other examples

of valuable enlarged models in this class are: micrometer, slide rule, wood joints, radio tube, and other small objects needed for class instruction.

The enlarged model shown in Figure 6-26 represents a very useful type of teaching aid. It is a wooden model of a tool bit or cutting tool made eight times the regular size. It enables the instructor to explain to a large group the necessity for correct grinding of this cutting tool. The parts to be ground away are explained in the proper sequence by the removal of the loose pieces shown in the picture.



6-27. Device for teaching the parts of an inch.



6-28. Reduced model of a plumbing system for a small house.

The instructor's time is saved by the use of this enlarged model prior to the practice grinding on the part of the learners.

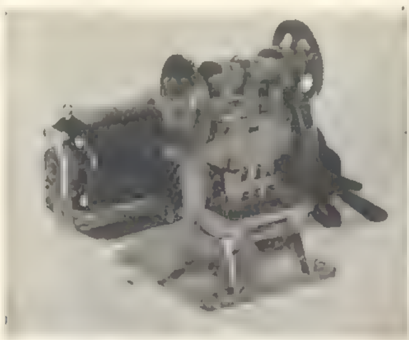
The device shown in Figure 6-27 resembles the Chinese abacus and is used to teach the divisions of an inch. It is greatly enlarged to permit the instruction of a sizable group at one time. The individual movable sections represent one sixteenth of an inch. This teaching aid enlists student participation and allows the "building up" of various divisions of the measuring rule.

4. *Reduced Model*

The reduced model is used less frequently than some of the other types of teaching aids. Its use is necessary when the real object is too large to be used in the school classroom or shop for instructional

purposes. A good example is the working model of a plumbing system (18″ x 24″) in a small home shown in Figure 6-28.

The reduced model is necessary if the learner is to see and understand the relationship and function of the various parts of the system. In this visual aid one can see the whole system with one look, which is a considerable advantage over going from one floor of a house to another and viewing one section of the system at a time. The reduced model enables the instructor to teach the main points in the operation of a large unit. If the student's attention is concentrated on the "main points" and learns how the thing works, he is ready then to approach the real job or mechanism.



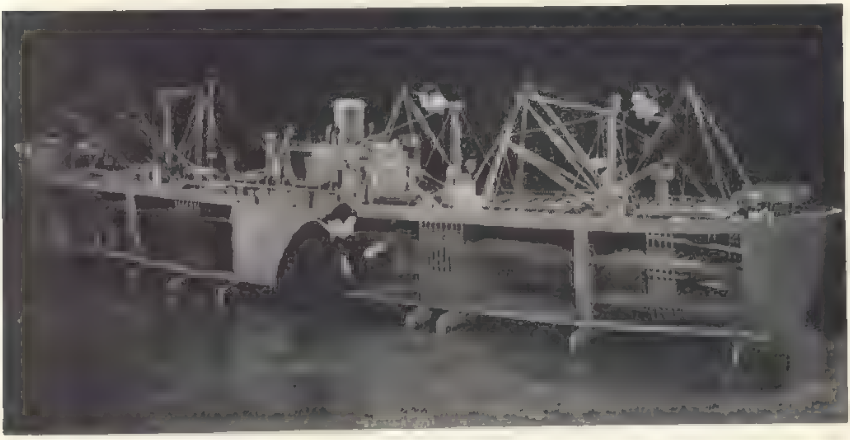
6-29. Operating miniature punch press.

Another reduced model used because the real thing could not be made available is the miniature punch press (Figure 6-29). This is an actual working model with a small die for punching holes about ⅛ inch in diameter. This machine, because of the inherent hazards involved, is not found in very many school machine shops. The boys learning machine shop practice should know how the machine operates in order that they may construct intelligently, punches and dies which are a part of an advance machine shop course. Invariably a visual device of this kind will tell the story briefly, clearly, and interestingly.

A very elaborate model in size and detail is shown in Figure 6-30. It is easy to understand the value of such a reduced model for instruction on ship construction. In a very compact and convenient form the function, relationships, and co-ordination of the ship structure, gear, and accessories are clarified.

5. *Scale Model*

The problem of shop layout presents itself whenever new equipment is purchased or old equipment is to be rearranged or moved to a new location. The usual procedure has been to cut out two-dimensional templets drawn to scale and representing the floor space required for each machine or piece of equipment. This method has produced semi-satisfactory results over a long period of time. However, the lack of a third dimension in the templets has resulted in many errors. The use of these templets requires a considerable



6-30. Reduced detailed cross-sectional scale model of a ship.

amount of imagination to visualize the final arrangement. Invariably many minor factors are overlooked, and omissions and interferences are not discovered until they are costly in time and inconvenience.

The use of reduced scale models removes all the shortcomings of the templet method. The models have not only all the advantages of the templets but have additional assets; the only objection to be presented against the model method is the initial cost, if they are made by a model maker. It is possible to have the models made in the school shops or to purchase them from commercial firms that make them on a production basis.

The following suggestions will be helpful to persons anticipating the use of models for shop planning.

1. Design the models to be readily distinguishable. The special characteristics of each machine should be worked out in sufficient detail to permit recognition by one whose trade experience is limited.
2. Avoid unnecessary detail such as small handles, levers, and gears. They add little to the utility but do increase the possible breakage.
3. Do not carry simplicity to the point of distortion, since the effectiveness of the models will be impaired.

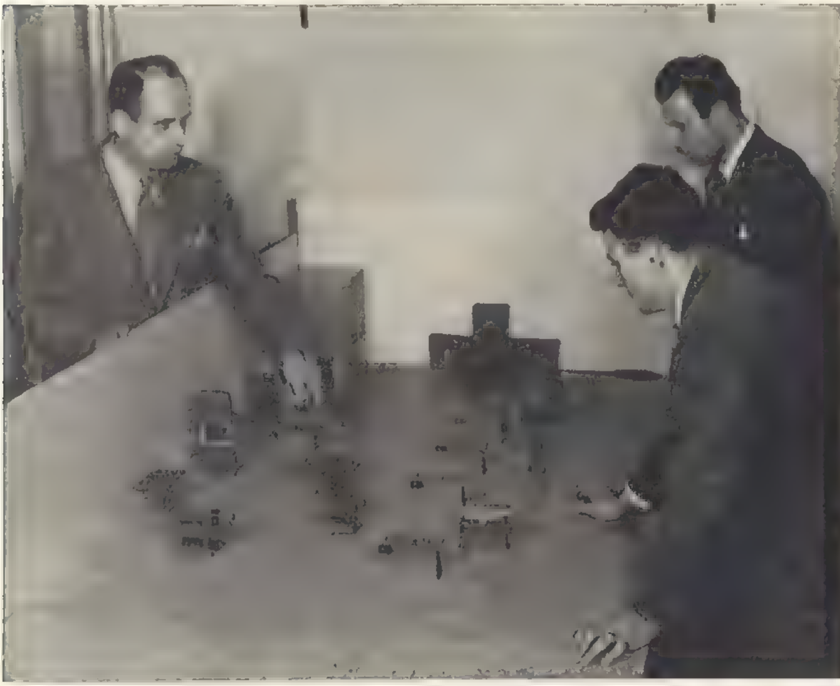
6-31. Scale model of a shaper, 1 inch to a foot.

4. Construct models of substantial materials to extend the life of their use. Each model should be of sufficient weight to remain where located.
5. Paint models according to the modern color code recommended by experts. This procedure will give a true picture of the final appearance of the proposed shop.
6. Use mannequins made to scale to determine adequate space: for the operators of the machines they will prove to be an added advantage. Each mannequin should be mounted on a metal disc about $1\frac{1}{2}$ inches in diameter and $\frac{1}{8}$ inch thick for added weight, thus enabling them to remain where placed.

Figure 6-31 shows a model made to a one-inch scale. Although the details of construction are absent, the machine can be recognized by one slightly familiar with this type of equipment.

Figure 6-32 shows a class in shop organization using the models in studying wood shop layout.

Figure 6-33 shows a machine shop layout with the use of models.



6-32. Instruction in the use of scale model for shop layouts.

This method permits the desirable adjustments and removal of "bugs" before a costly installation is made. It assures adequate areas for assembly, temporary or permanent material storage, aisle space, also tool rooms and teacher's office. This technique is highly recommended to vocational directors and teacher training schools because it gives reality to this important project.

6. *Transparent Model*

The rather recent development of plastics has stimulated the making of plastic models for teaching purposes. Their chief value

is the advantage they give the learner of viewing the interior and also the rear and side views from a single position. Figure 6-34 shows geometric solids made of plastic with the edges painted black to give emphasis to the intersection of the different surfaces. This is a very valuable teaching aid for use in a drafting room. It enables the student to visualize the intersecting planes and the resultant

6-33. Complete shop layout using scale models.

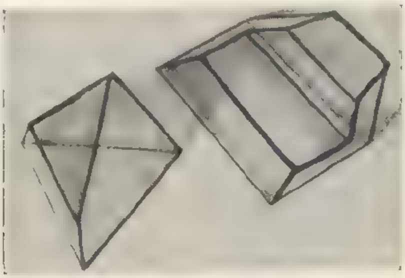
shape. A resourceful teacher will find many unique uses of plastics in connection with the construction of teaching aids to vitalize his teaching.

7. *Mock-up*

This form of teaching device was extensively used in the training program of World War II. It consists of a mechanism such as an automobile brake or the hydraulic system of an airplane removed from the bigger unit of which it is a part. It is mounted in such a way that it may be operated in the usual manner by electric, hydraulic, or pneumatic power. Some of the parts are foreshortened

to reduce the space necessary to operate it. Through this procedure it is possible for the learner to view the mechanism and its co-ordinating parts from a single viewing position. It is a very effective teaching device in the field of vocational and technical education.

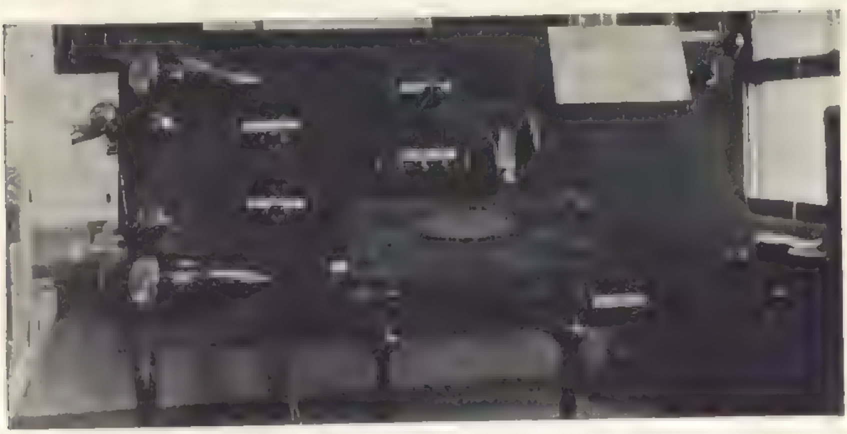
This teaching aid has some features of the reduced type with the exception that the operating mechanism is the standard article, but the co-ordinating parts are usually reduced in size and form.



6-34. Geometric solids made of plastic. (*Courtesy F. N. Newton, Sharon, Pa.*)

A very useful mock-up for teaching automotive ignition is shown in Figure 6-35. All the electrical units from distributor to tail light are mounted on a large panel in full view of the learner which enables him to easily understand the function, operation, and relationship of the various units.

Figure 6-36 shows a mock-up of the lighting system on an airplane which was used in the army training program.



6-35. Mock-up of a complete automobile electric system.

Conclusion

The examples given in this chapter should stimulate teachers to make adaptations to the ideas when teaching their particular subject. In this book it is possible to present only typical examples. The resourcefulness of teachers to devise aids suitable to their individual needs is assumed.

6-36. Mock-up of airplane lighting system.

REFERENCES

Striping Tools

1. Wendell Manufacturing Co., 4234 N. Lincoln Ave., Chicago, Illinois.

Lettering Aids

1. Bulletin Boards and Directory Products, Inc., 724 Broadway, New York.
2. Joseph Mayer Co., Inc., 59 Union Square West, New York.
3. Eagle Art Supply Co., 331 West 42nd Street, New York.

4. The Redikut Letter Co., 2902 West 76th Street, Los Angeles 43, California. (Circular and samples sent upon request.)
5. The Tablet and Ticket Co., 115 East 23rd Street, New York. (Catalogue sent upon request.)

Casein Colors and Aniline Dyes

1. Prescott Paint Company, New York.

Paste

1. Manhattan Glue and Paste Co., 425 Greenpoint Avenue, Brooklyn, New York.

Staplers

1. Star Paper Fastener Co., Norwalk, Connecticut.

Art Supply Stores

1. Arthur Brown & Bro., 67 W. 44th St., New York City.
2. Joseph Mayer Co., Inc., 59 Union Square West, New York City.

CHAPTER VII

How to Make, Display, and Use Charts

The best visual aids are those designed specifically to meet some particular teaching problem. Commercial teaching aids, that is, the charts, the models, the displays and the samples made available by manufacturers for instruction purposes, are valuable, but their limitations must be recognized. When a commercial teaching aid is produced, the motive behind it is generally to assist in the sale of a product or a service. The producer wishes to explain some advantageous feature, assure a more effective use of the product, or win good will by assisting the user in problems relating to the product. Meeting some specific teaching problem is not the underlying purpose of the commercial teaching aid, although it may frequently have considerable value as such. Common faults of such aids, particularly charts, are that they often contain too much material for the teacher's needs, illustrations and printing are too small and cluttered up for class use, and frequently material irrelevant to the instruction dominates the situation.

The Need for Designing and Constructing Visual Aids

The teacher's problem is to help others to learn, and when this becomes difficult the teacher must seek aid through the use of pictures, charts, diagrams, models, samples, displays, and other aids. These visual aids are as much a part of the specialized equipment needed by the teacher as the training required to teach. This specialized equipment, that is, aids designed particularly to teach, are of little commercial interest to producers. Therefore many, if not most, of the really effective and useful aids must be constructed by those interested directly in the teaching or training at hand.

Not only are visual aids of the commercial type limited in scope and applicability, but they are usually restricted to the chart or poster type of teaching aid. Unfortunately many ideas cannot be

clearly or adequately conveyed by this means, and more elaborate and realistic representation is needed. When motion and third-dimensional qualities are involved, models and actual materials become important. Many of the major teaching problems, particularly in the mechanical fields, require models for effective visualization. Those who wish to teach both effectively and efficiently must anticipate the need and expect to produce, for the most part, their own visual aids designed for their particular problem.

When Should Visual Aids Be Specially Made?

Design and make only those visual aids for which a definite need exists, that is, some definite difficulty has been encountered or anticipated in conveying an idea or point to the learner. A need exists when the learner cannot clearly follow some procedure which you have just explained or demonstrated, when the learner fails to comprehend some principle or theory you have presented, or when the instruction time becomes unnecessarily long and drawn out. Visual aids in themselves are not necessarily valuable unless they help the teacher accomplish something that would be more difficult and time consuming without their use. The work involved in the design and construction, and the inconvenience in handling of some visual aids, may far offset the small contribution they make to the teaching-learning situation. Do not construct or use visual aids for visual aids' sake; but every teacher should obtain by some means—charts, models, displays, pictures—when:

1. Difficulty is experienced in getting over an idea or an important point, for example, the principle of the automobile differential, the difference between the teeth in the cross-cut and the rip saw, or the construction of a storage battery.
2. The teaching time can be shortened by helping the learner to grasp the idea or process more quickly through some device to supplement your presentation.
3. An abstract idea or concept is to be conveyed, for example, the atomic theory, the principle of magnetism, the structural changes during heat-treatment, or the principle involved in the sewing machine.

Good visual aids are not necessarily complicated or involved. Some of the best are those which clarify or convey some simple but

basic idea; for example, the visual aid shown in Figure 7-2 clearly and convincingly demonstrates how and why one must start a hack saw across the broad face of the stock and at a low angle with the surface. Thirty seconds with the visual aid may replace thirty minutes of verbal explanation, and a teaching headache may be eliminated. A simple sketch on the blackboard or the mere spelling out of a new term may be the difference between learned and unlearned.

How to Make Charts

Charts are the easiest and the most convenient form of visual aid to construct with the possible exception of the blackboard drawing. When a few tricks and devices used by professionals are known and applied, even the most inexperienced can produce surprising results. The display of charts shown on the opposite page were produced by tradesmen with no previous training except the instruction given during the time the charts were being made. This same instruction is presented in the following pages which describe and explain the techniques used.

7-1. An enlarged model—well constructed but hardly worth the time and trouble required for its limited instructional value.

7-2. A very simple but effective teaching aid because it makes obvious the obscure action of the hacksaw teeth.

Choosing material for a chart is the first important step in producing one. The useful life and very often the value of the chart itself will be determined by the material of which it is made. Charts worth making are worth making well, particularly when they are to be used repeatedly. The longer their useful life, the greater the return for the investment in time and effort. Choose the best material suited to the job. Don't put a lot of work and time on any old


Watch
WAS IT OUT
WHEN YOU
FILLER CAP
CHECK VALVE
PRIMARY CUP
PISTON
RETURN SPRING
SECONDARY CUP
BOOT STRAP
RETAINER SPRING
LINK
PISTON STOP
BOOT
BOOT STRAP

7-2a. Posters.

piece of cardboard just because it is handy. The selection of the best material to use will depend on:

1. The size the chart will be when completed. The larger the chart the stronger and stiffer the material must be.
2. The extent to which the chart will be used or the length of time it will be in service. Charts which will be used extensively should be made of the best stock available.
3. The use to which the chart is to be put. Special consideration must be given to chart material that is to be handled a great deal and subject to transportation. The method of storage—whether it must be rolled, kept flat, or folded—will also need to be considered.

The principal items for consideration in selecting chart material are strength, weight, type of surface, color, and cost. The following pages list these qualities for a number of materials which have proved suitable for chart and poster use.

Materials suitable for chart use fall into three general classes: (1) the paper boards sold by paper companies, printing firms, art supply houses, and stationery stores, (2) the wall boards sold by lumber yards and building supply dealers, and (3) cloth materials such as sign painter's cloth, roller type window shades, and the many coated fabrics.

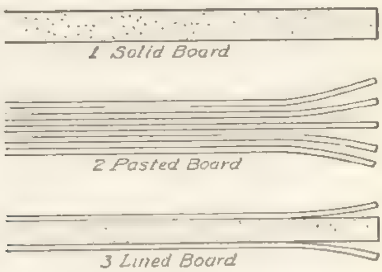
Paperboard[1] is the general class name for all fibrous material 0.012 inches or more in thickness produced on the paperboard machine and generally spoken of as "cardboard." Paperboards are commonly made in three basic forms: (1) *solid boards*, a paperboard made of a single layer of the same material throughout; (2) *pasted board*, a paperboard made up of layers (ply) of thin stock pasted together to form a board of the desired thickness; and (3) *lined boards*, any paperboard to which a better grade of paper has been added to one or both sides to provide a more suitable surface for the purpose intended.

Paperboards are so numerous in varieties of structure, size, thickness, surface treatment, durability, rigidity, and color that only a few of those most suited to chart work will be described in detail.

[1] *The Paper Sales Yearbook*, 1944 Edition, Davidson Publishing Co., Chicago, Illinois.

The pasted boards in general are stiffer and more desirable than solid boards. All types can be secured from wholesale paper houses, stationery stores and art supply stores, but the most widely used paperboards are:

Newsboard, solid—This brownish to gray colored paperboard is made primarily from old newsprint. It is usually a soft light board lacking in strength with a surface unsuited to drawing. Its chief advantage is its low cost and its best use would be for inexpensive temporary mounting purposes.



7-3. Three basic forms of paper board.

Newsboard, pasted—Pasted newsboard varies considerably in hardness and surface texture. An 18-ply pasted newsboard with water finish provides a good inexpensive mounting board of fair strength and appearance suitable for mounting photographs and other paper material. Its smooth texture is not suitable as a drawing surface and should not be used for this purpose.

Newsboard, lined—Both solid and pasted newsboard is often covered on one or both sides with a good grade of surface paper, usually white, to provide a better working surface than the bulk material of which the board is made. These paperboards are known as single or double "lined" paperboard. Pasted paperboard lined single or double with #70–#80 lithocoated or offset book papers will be found most satisfactory for chart work.

Poster board—A paperboard lined one or both sides with a coated or uncoated book paper. Essential characteristics are rigidity and smooth even surface adaptable for printing on cylinder presses or for use with pen, brush or silk screen. Principal uses are:

window and counter display cards, signs, posters, backgrounds, frame displays, and demonstration and lecture charts.

Sizes and weights: Available in 4, 6, 8, 14, 16, 22, 28 and 30 ply. Sheet sizes generally stocked are 28″ x 44″ and 40″ x 60″.

Tag stock—Tag stocks are so named because they were originally produced especially for conversion into shipping tags. This paperboard may be made from a number of different pulp furnishes, including rope, jute, bleached or unbleached sulphite or sulphate, or mixtures of these with or without ground woodpulp. Most tag stock has the following characteristics, the extent of which depends on its intended use: good folding qualities, good tensile and tear strength, moisture resistance and surface adaptability to printing, stamping or pen and ink writing. Tag stock is generally a manila or buff color, though it is also available in white or colored on one or both sides.

Show card and display board—Show card and display boards are pasted boards made with a news middle, a paper backing to eliminate warping, and a coated facing paper. Usually about 0.045 of an inch in thickness, they are available in a wide variety of colors. The colors must be nonfading, nonbleeding, and free from glare or surface marks. Show card and display boards are excellent for silk screen work and are widely used for show card and display signs. The standard size of these boards is 28 x 24.

Mat boards—Mat boards are made of solid white or cream-colored wood pulp middles, lined or faced with plain or fancy papers. The middles are firm and the same color throughout so that when the mat opening is cut, a clean edge shows and a sharp outline is formed along the cut. The most popular finishes are antique, pebble, and stipple. Its most common use is for mounting and framing pictures but is excellent for small signs and charts where quality and attractiveness are important. The surface takes ink and color very well, particularly the antique finish which is smoother and easier to work on in small detail. Thickness or weight is indicated by thin, thick, double thick, and triple thick corresponding to 0.040, 0.080, 0.120, and 0.160 of an inch. Standard sheet size is 30 x 40, 28 x 44 and 40 x 60 are also available.

Stencil board (oiled)—A highly calendered paperboard impregnated with linseed or other oil to give it a tough-surfaced, long-

wearing quality. It cuts evenly and resists penetration of ink and fuzzing of edges from continuous brushing. The usual color is a natural kraft or canary yellow. Sheets are available in 20 x 24, 20 x 30, and 24 x 36 sizes. The principal use is for the making of stencils where the same pattern or lettering is to be used repeatedly.

Bristols—Bristol is a general term designating a particular group of stiff, heavy papers, ranging in thickness from 0.006 of an inch upward. They are broadly classified as: (1) those used for commercial writing purposes—index bristols and cream postcard; (2) those used for commercial printing purposes—printing bristols, folding bristols, coated postcard and bogus bristols; and (3) those used for social writing purposes—wedding bristols. Bristols generally are suitable for small work only, since it lacks stiffness necessary for large charts and displays.

Index bristols are used extensively for filing and record systems and therefore must be snappy and capable of withstanding a great deal of handling. The surface is suitable for writing, erasing, and rewriting, hence is satisfactory for many forms of charts and displays where large size is not required. Standard sheet sizes are 20½ x 24¾, 22½ x 28½, 25½ x 30½.

Printing bristols are generally stiffer than index bristols, have an uncoated surface either of an antique (rough) finish or a plate (smooth) finish and are adapted to all forms of printing. Writing and erasing qualities not as good as index bristol. Main characteristics are uniformity of surface and thickness, cleanliness of appearance and strength. Available in a variety of colors and a basic sheet size of 22½ x 28½.

Bogus bristols sometimes called "ticket bristol" are made in a wide variety of colors and used principally for tickets, show cards, advertising cards, etc. This is an inexpensive bristol suitable for temporary purposes where light weight and color are required. Standard size is 22½ x 28½ and weights vary as follows: 90 lb. (2 ply); 120 lb. (3 ply).

Wedding bristol represents the finest of all bristols to be used when permanence and quality are important. Wedding bristol is made by pasting together two or more sheets of wedding paper. The finish is usually a smooth plate or a vellum (dull or "kid" finish) and occasionally a linen, crash, or super-calendered finish.

Wedding bristols are strong and stiff, have an immaculately clean appearance, a delicate surface texture, and work well under pencil, pen, or brush. The basic size is 22½ x 28½; weight varies according to the ply.

Blanks—A card stock of several types used where good printing qualities, stiffness, and durability are required. Blanks are always made of filled stock, the middle, or the filler, being composed of either a single thickness of stock or a number of thicknesses pasted together. The middle varies in the different qualities from a No. 2 news furnish to that of a sulphite or rope stock. They are generally lined with book paper on one or both sides and then left plain or coated. Three types of blanks are particularly suited for use in small charts, mountings and displays.

Plain blanks also called "mill blanks," which comes in two grades, No. 1 and No. 2. The No. 2 grade is generally dirtier, softer and does not have as good a color as the No. 1 grade. Suitable for window cards, posters, display cards, and small signs. Standard sizes are 22 x 28 and 28 x 44. Weights vary from 2 ply (120 lb.—22 x 28-500) to 16 ply (775 lb.—22 x 28-500).

Coated blanks are basically the same as plain blanks except that this type of blank is single- or double-coated on one or both sides with china clay and then super-calendered or plated to a high finish. This treatment produces a surface particularly adaptable for various kinds of letterpress printing and lithography. The uses, sizes, and weights of this blank are the same as those for the plain blanks.

Railroad board—This paperboard is a colored blank usually with a gray filler and may be coated or uncoated. Available in a wide range of colors it is also known as "railroad ticket" and "railroad stock." Its principal use is for mailing cards, tickets, show cards, posters, etc. Standard sheet size is 22 x 28. Usually available either in 4 or 6 ply.

Paperboard thickness is indicated in three ways: "ply" (the number of sheets pasted together); "points" (one point equals a thousandth of an inch); and "basic weight" (the weight of a ream, usually 500 sheets, of a specified size). While paperboard is sold in the wholesale trade by basic weight, it is of little help to the average person in visualizing the actual thickness or stiffness of the sheet.

The table below will aid in making an approximate comparison between the measures when given in "ply" or "points." It should help to visualize the actual thickness for the more common commercial sizes.

COMPARATIVE MEASURES OF PAPER BOARD THICKNESSES

Actual Thickness	*Ply*	*Points*	*Th'ths Inch*	*Fractions of Inch*
	2	12	0.012	
	3	15	.015	1/64
	4	18	.018	
	6	24	.024	
	8	30	.030	1/32
	10	36	.036	
	12	42	.042	
	14	48	.048	
	18	60	.060	1/16
	24	75	.075	
	—	100	.100	1/10
	—	125	.125	1/8
	—	187	.187	3/16
	—	250	0.250	1/4

The best thickness or weight of paperboard depends on the chart size and the manner in which it is to be supported. Generally, the larger the chart, the stiffer it must be, and therefore the heavier the material from which it is to be made. Keep in mind that weight or thickness may not necessarily be an index to stiffness of the material. The Sixth Annual Advertising and Publication Production Yearbook recommends the following:

Inches	*Points*
8 x 10 and under............	30–50
8 x 10 to 11 x 17............	50–65
11 x 17 to 17 x 22............	65–75
17 x 22 to 20 x 30............	75–100
20 x 30 to 30 x 40............	100–150
30 x 40 and over............	125 and up

Fabric Materials. Coated fabric or cloth material makes a very satisfactory chart material, particularly when it is desirable to roll the chart for storage or transportation.

Sign cloth is the least expensive of these materials and is satisfactory for temporary use. This material is muslin coated or sized on one side to produce a smooth semi-gloss surface. The reverse side is dull in appearance with a texture of the cloth itself. Either side may be used, but the coated side is easier and more generally used. Show card colors, japan and oil colors work well on sign cloth. The layout can be sketched in with pencil or charcoal, then finished by means of pen, striper, or brush.

When sign painter's cloth is attached to a frame, it can be stretched drum-tight by dampening with water after it has been tacked in place. Caution should be taken in handling sign cloth to avoid wrinkling, crumpling, and creasing. Rough handling breaks the sizing, destroys the stiffness of the cloth, and gives it a soiled appearance. The cloth comes in 60 or 100 yard rolls in widths of 36, 42, and 48 inches and may be purchased by the yard from art supply and dry goods stores.

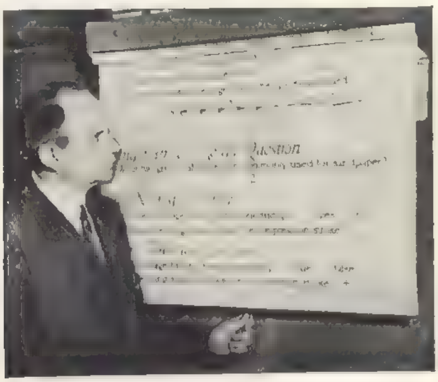
Sign painter's oil cloth is a dull-finished, white, coated fabric, heavier, more durable, and more satisfactory working surface than sign cloth. Oil cloth is more pliable, withstands handling and rough usage, therefore proves more satisfactory for charts which are to be rolled up, handled considerably, and stored for occasional use. Japan colors should be used on this material which comes in 50-inch width.

Roll window shades provide a very satisfactory chart material plus a convenient method of mounting and displaying when attached to the conventional roller. White or cream colored shades are best. India inks, japan colors, or oil paints may be used on shade material. Several grades of cloth are available, but best results are obtained with washable opaque materials that allow both sides to be used.

Wallboards. Many wallboards originally intended for building construction are very well suited for large charts and display boards. These boards are very stiff, light, well surfaced and are available in large sizes, usually 4 x 8 feet. Wallboard can be obtained from

lumber yards and building supply houses. Their chief qualities that make them suitable for visual aid work are:

1. Little tendency to warp, shrink, or swell.
2. Rigid, usually need no additional support except in very large sizes.
3. Adaptable to all types of finishes, water, oil, synthetic, and lacquer.



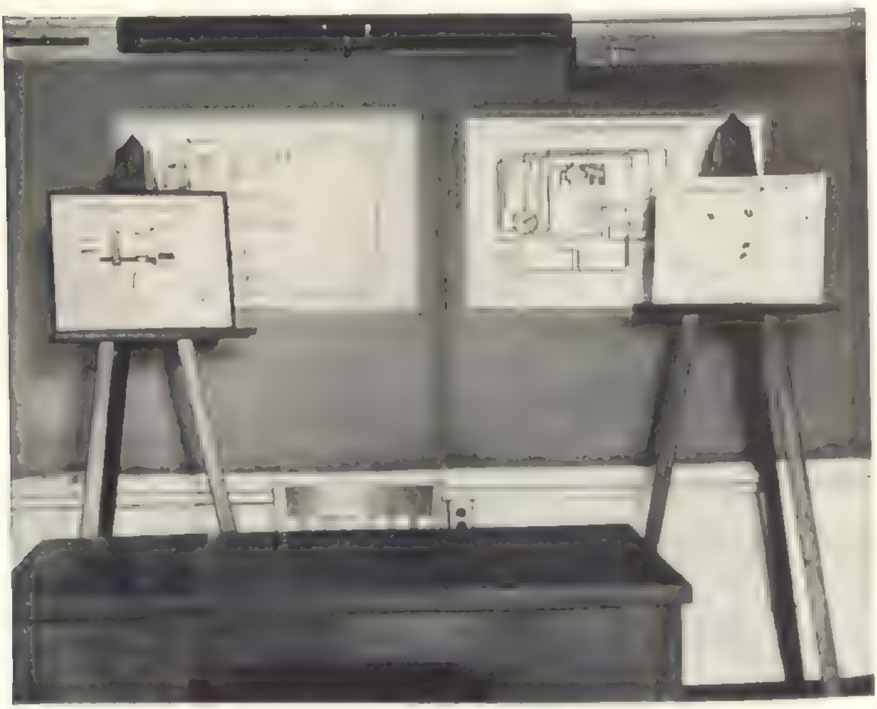
7-4. A white or cream-colored window shade makes an excellent rolled chart. Storage is easy and sketches may be revealed progressively as curtain is unrolled.

4. Possesses a hard durable surface suitable for drawing and mounting purposes.
5. Can be easily cut and worked with ordinary woodworking tools into special sizes and shapes.
6. Strong and stiff enough to be used for mounting tools, samples and parts.

Wallboard sold under the manufacturer's trade name is available in varied size, weight, and quality. Not all are handled by any one dealer, but the more common boards suitable for display purposes and some of their characteristics are listed below.

Name	*Description*
Beaver Board	Strong, light, pulp board suitable for drawing surface and mounting purposes.
Presdwood	Strong, heavy, hard, stiff board made from wood fiber. Face side unusually smooth and hard. Rough texture on the back. Very good for mounting purposes, excellent for construction work.

Chart size should be determined by the conditions under which the chart is to be used. The number who must view the chart at any one time, the distance from which it must be viewed, and the nature of the material appearing on the chart determine the approxi-



7-5. Chart size is not as important as the size of the material on the chart, compare the small and large charts above for readability.

mate size in each case. The exact dimensions will be determined for the most part by the stock sizes of the cardboard or composition board from which the chart is to be made. Figure 7-5 shows two 30″ x 40″ charts on easels being used before a class of thirty in a

7-6. Remember what looks large enough to the teacher when he works close to a chart may appear too small for the learner from a distance. The example above shows the revised chart one teacher made after viewing his original from the back of the room.

standard classroom 23′ x 28′. Note the difference in the legibility, due largely to the nature of the material appearing on each. The size of the chart on the left is correct for the material displayed, the one on the right too small.

The large charts mounted on the blackboard are 22″ x 28″. Compare these two charts for legibility with reference to size and then do the same with the smaller charts on the easels. Note how the

small chart on the left appears more readable than the corresponding larger chart behind it on the blackboard. The chart size is correct when the material on the chart can be seen clearly by the persons who will have to view it at the greatest distance. Figure 7-6 shows two charts taken at a distance of fourteen feet. The small one was made first by the instructor to aid him in discussing "V" threads. Realizing his error after asking for suggestions for its improvement, he made the second enlarged copy at the top. If you were the student, which would you prefer?

The two charts in Figure 7-7 are each 40″ x 60″ and were used for instructing groups of one hundred at a time. They proved satisfactory and readable up to distances of 75 feet.

The table below suggests chart sizes that are recommended for varying conditions of distance and type of material appearing on the chart. Standardize on the stock sizes, for example, 17 x 22, 20 x 24, 22 x 28, 28 x 44, 30 x 40, 40 x 60.

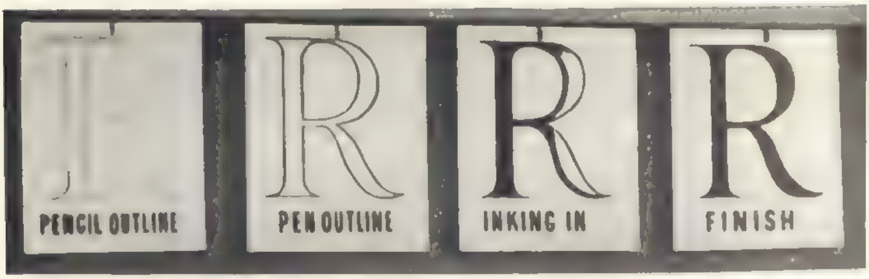
Maximum Viewing Distance (feet)	Stock Sizes Recommended		
	Small Detail	Average Material	No Small Detail
10	22 x 28	20 x 24	17 x 22
25	28 x 44	22 x 28	20 x 24
45	36 x 48	28 x 44	22 x 28
75	40 x 60	30 x 40	28 x 44
150	60 x 80 $\left(\overset{2}{40 \times 60}\right)$	48 x 72	40 x 60

Follow the principle in chart construction of making it large: "if in doubt make it larger," might well be applied here. Charts that are too large are rare; those that are too small are numberless. The final dimensions of a chart might well be chosen with some thought of standardization of size for greater convenience in handling and storage. The chart sizes listed in the foregoing table have been selected with this point in mind.

Steps in a procedure can often be placed on a series of small,

7-7. Charts may be used with large groups if the chart and the material on them are sufficiently large. This picture taken at the rear of an audience of 100 shows clearly the advantage of large lettering and clear simple illustrations.

separate charts rather than have all illustrations on a single large chart (Figure 7-8). This practice has two distinct advantages: *first*, each illustration can be made larger, and, *second*, each can be presented separately as required. We remember a procedure more vividly when we see each step presented individually in their correct sequence rather than be confused by all the illustrations presented simultaneously. Better results would be obtained with many of our visual aids if we followed the "one thing at a time" principle. Steps in the filing of a saw, making a wood joint, tying a knot, forming a lock joint in sheet metal, locking up a form in printing, etc., are good examples of operations that could be presented more effectively with



7-8. A series of small charts to illustrate a procedure "one step at a time" often proves more effective than a single, large chart with several illustrations on it.

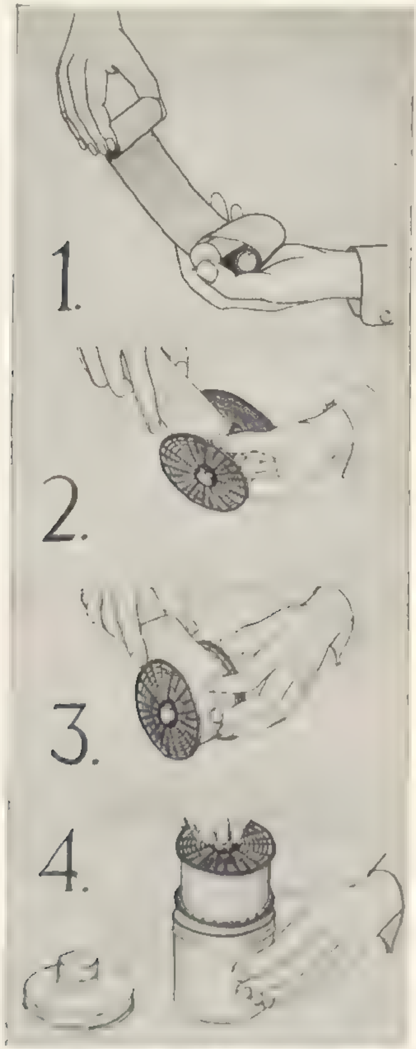
a series of small charts depicting each step rather than the larger but more confusing single chart. The series of four charts showing the sequence of steps in loading a film tank proved very helpful. These charts are presented one at a time in correct sequence until all are on view as an over-all picture of the process.

How to Make Charts Using Line Drawings

Line drawings are one of the easiest, and often most effective, forms of illustration to produce for chart display (Figure 7-10). Few have the ability to make good original line drawings, but anyone without special skill or training can reproduce line drawings satisfactorily for chart use by applying the techniques and methods described and illustrated in the following pages. No previous drawing or art ability is assumed, nor is there any attempt made herein to develop it. Mechanical devices and "trade kinks" are freely advo-

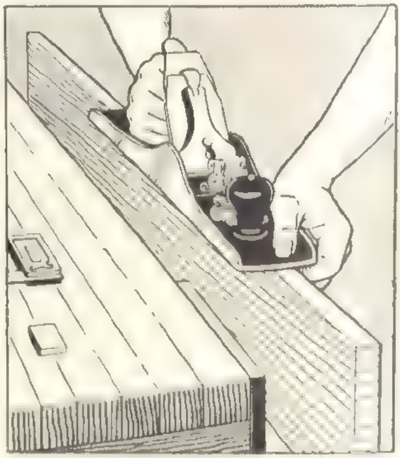
cated and explained as a means of producing effective visual aids with the least amount of time and effort.

Locating the drawing on the chart is an important preliminary step. This is done by blocking in the major portions and the over-all



7-9. How to load a film tank in four simple steps. A series of charts like these allow the teacher to build the lesson one step at a time ending up with the full sequence in view.

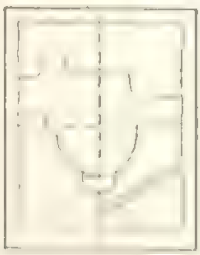
dimensions in outline form. Centerlines running crosswise and lengthwise through the center of the sheet will serve as base lines from which to work. Remember when laying out the drawing that



7-10. Line drawings are frequently more instructive than photographs or halftones. These are actual text illustrations attempting to convey the same idea.

the optical center is slightly above the actual center and that the completed drawing will appear more pleasing when located around this optical center.

Pencil in the margins with a light line. The margins on all sides

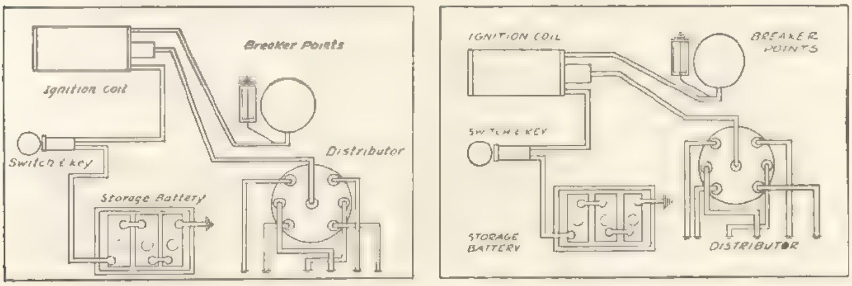


7-11. Sketching in border lines and centerlines help in locating the drawing on the sheet

should be equal with the exception of the bottom which may be somewhat wider for an approved appearance. The width of margins depends largely on the size of the chart. A margin of ½" to 1" appears well on a 17" x 22" chart while one of 1" to 1½" looks better

for a chart as large as 30″ x 40″. Other sizes might well be made proportionally.

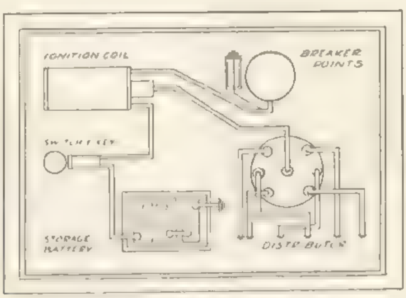
The charts in Figure 7-12 show the marked improvement in appearance resulting from a careful consideration of margins. Note



A B

7-12. Margins improve the chart. Note the improved appearance of chart B over chart A, identical except at margin

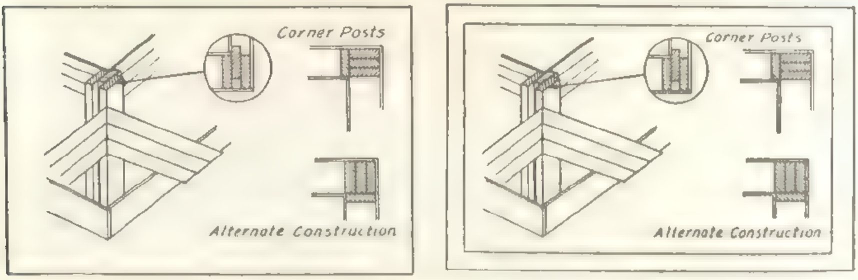
how the lettering on the chart at the right conforms with the margin and in some cases actually forms a portion of it. Margins formed with or without the use of a borderline frame a picture or illustration and strengthen the attention-getting and -holding appeal which it may possess.



7-13. Borders may help to hold an illustration together but note how the chart shown in the preceding figure (B) is made less effective with a line border.

Border lines may be used to strengthen the margins and in some cases to hold together a group of disconnected drawings. Their use in many cases is purely a matter of personal opinion and sometimes questionable from an instructional point of view. Figure 7-13 re-

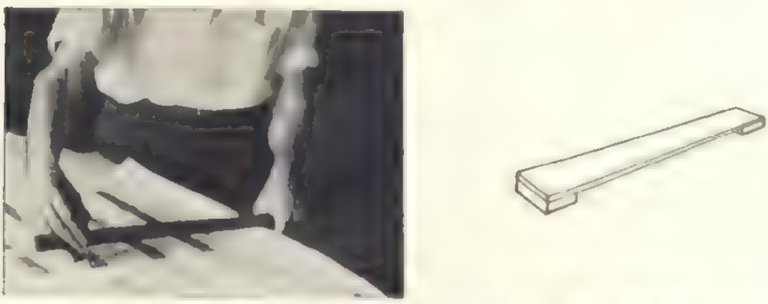
produces the chart shown in Figure 7-12 with the addition of a border. Little seems to have been gained in improving its effectiveness for instructional purposes. On the other hand the border line used on the right-hand chart illustrated in Figure 7-14 does much



7-14. A border line helps in this case because the scattered sketches need something to tie them together.

to hold the separate drawings and hold attention within the chart itself.

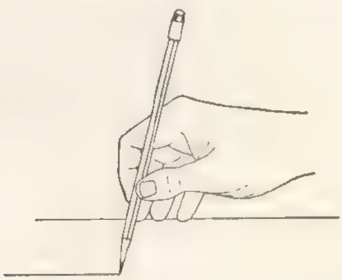
Short-cuts in layout work have been developed by sign painters and showcard writers to speed up production and improve the quality of their work. Many of their techniques can be employed by



7-15. Parallel lines can be drawn accurately and quickly with the use of a rule or stick as shown above. A sign painter's "bridge" is sometimes useful for the same purpose when a surface is wet or must be kept clean.

the novice to overcome his lack of special ability or training. For poster and chart work professionals use a slanting work table fitted with a strip of wood along the front edge which projects one quarter to three eighths of an inch above the edge of the table. This projection serves as a holding device for the work and a guide for drawing

horizontal and parallel lines. Horizontal and vertical lines may be drawn with the familiar T square and triangle but can be drawn more quickly and reasonably accurate by holding a yardstick or straightedge along the side or bottom edge of the table as a guide. This procedure is best illustrated in Figure 7-15. Be sure the straightedge or yardstick remains at right angles to the edge being used as a guide. Some sign painters and show card writers prefer to use a "bridge" such as that illustrated in Figure 7-15. This device



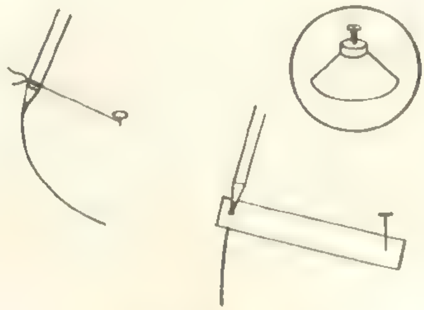
7-16. Lines parallel to the edge such as border lines can be quickly drawn by using the fingers along the edge of the stock as a guide.

merely consists of a straightedge supported at each end by a small block which holds the straightedge away from the surface of the material being worked upon.

Border lines or lines parallel and near the edge of the chart can be drawn by allowing the fingers to act as a guide along the edge of the material upon which you are working. Figure 7-16 illustrates this trade kink. Note the unusual method of holding the pencil or brush with the thumb on top rather than below or at the side and the first finger supporting the drawing tool from underneath.

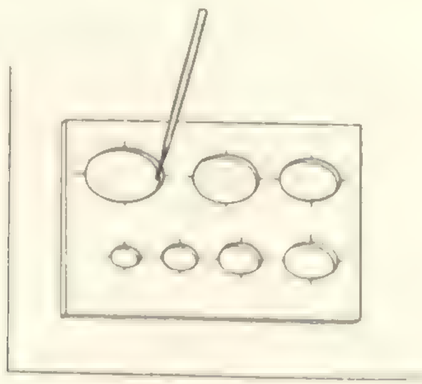
Circles and arcs can be drawn by (1) means of a piece of string and a thumbtack or brad (Figure 7-17). Keep the string uniformly taut and attach it by means of the simple knot shown on page 141. A small vacuum cup may be substituted for the pin or tack, thus eliminating the center mark. A good substitute for the string may be found by using a strip of cardboard held in place with a tack and a small hole punched in the other end for the pencil. The radius can be quickly changed by changing the position of the pin (Figure

7-17). The cardboard strip has the advantage of greater accuracy and a fixed setting. Templates made of wood, cardboard, sheet-metal or a transparent plastic are very useful for small-diameter circles and arcs. These may be home-made or purchased from art



7-17. Drawing circles on charts may be done quickly and easily with a string and center pin; with a vacuum cup for a center; with a strip of cardboard.

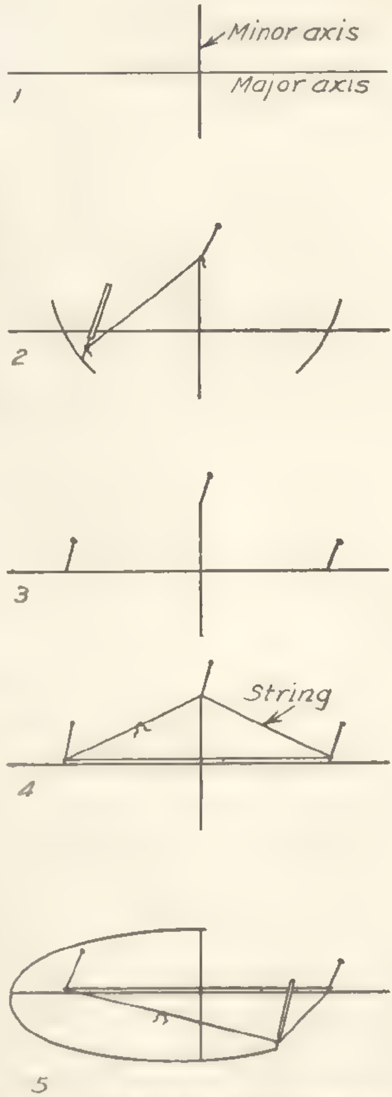
and drawing supply stores. Inside templates are generally more satisfactory than trying to draw around the outside of a pattern because of the natural tendency of the pencil or pen to move outward. Figure 7-18 illustrates the use of an inside template with a variety of small circles available.



7-18. Using a template for drawing circles, elipses, and arcs is particularly useful for small radii, e.g., one inch or less.

Ovals or Ellipses can most easily be drawn to any dimension by the use of a piece of string and two tacks or pins or the use of the vacuum cups mentioned previously.

1. Draw the two axes, major and minor, at right angles to each other and of the desired length.
2. Using pencil and string swing an arc from one end of the minor axis with a radius equal to one half the length of the major axis. Cut the major axis near either end. The points of intersection will become the two centers of the ellipse.
3. Place two pins on the centers just located and a third pin at one end of the minor axis.
4. Form a loop around the three pins by tying the piece of string snugly to form a triangle around the pins.
5. Replace the pin at the end of the minor axis with the pencil point. Keeping the string taut, move the pencil around the two pins to the limit of the string. Result will be a reasonably accurate ellipse or oval of the desired size.

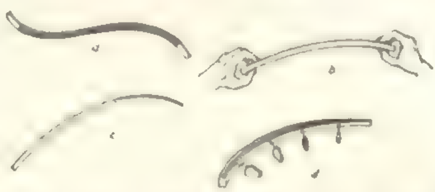


7-19. Five steps in the construction of an ellipse using a string and two pins, tacks, or brads placed at the desired centers.

Irregular curves can be drawn with the familiar French curve or a flexible ruler. Either type of instrument is available at all drawing supply stores in several types and sizes. The French curve is used by choosing the section of the curve by trial and drawing small sections of the desired curve, if it is large, by repeated applications.

7-20. One type of French curve for drawing curved lines other than true arcs.

Always be sure that each section lies tangent to the adjacent one by providing sufficient overlap when placing the curve in position. The flexible rule is so made that it may be formed into any desired curve and then retain its shape sufficiently to use it as a drawing guide. Various patented forms of this rule are available from drawing supply stores. For many purposes where great accuracy is not

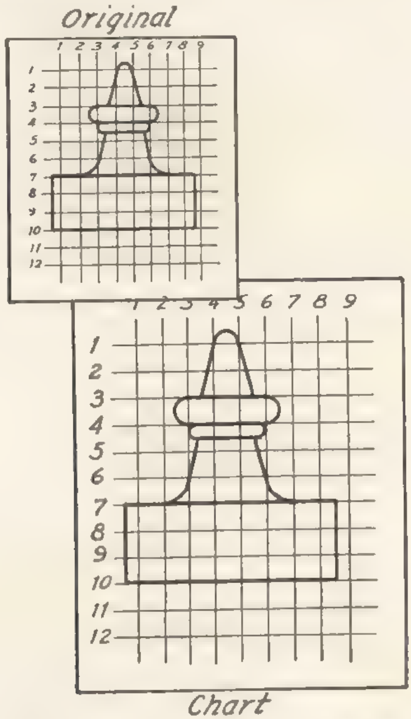


7-20a. Four forms of guides for drawing irregular curves: (a) a flexible rule which remains in the position in which it is placed; (b) a wood strip of uniform thickness which is sprung to give desired curve; (c) a tapered wood strip sprung to give a more varied change in direction; (d) a spline and weights which may be bent to shape and then held in place by the weight while curve is being traced.

important home made guides will work very satisfactory, for example, a wire bent to the desired shape, a piece of roll solder, a thin strip of wood, uniform in thickness for a uniform curve and tapered in thickness for a varying curve. Commercial strips of celluloid called "splines" are used in a similar manner with the addition of spline weights that hold the spline in the desired position while the line is drawn.

How to Transfer Drawings to a Chart

Illustrations appearing in books, magazines, pamphlets, and advertising literature provide the bulk of the source material desired in chart form. These original illustrations are invariably too small for most instructional purposes and must be enlarged as well as reproduced.

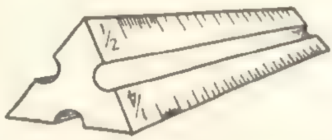


7-21. The square method of transferring drawings. The size of the enlarged sketch will depend on ratio of the squares.

duced. Since enlargement is necessary, the more common forms of reproduction or transfer such as tracing with carbon paper are unsuited for the purpose. There are however several methods of transferring and enlarging a drawing simultaneously.

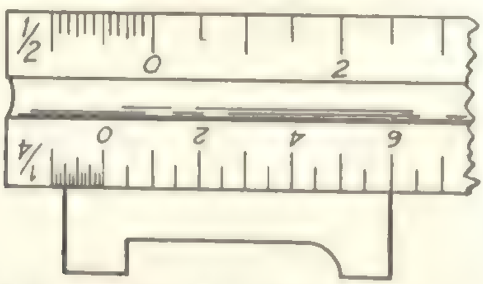
The square method is a simple and effective method of transferring and enlarging a drawing where exactness is not essential and the individual possesses some drawing ability. The original copy is ruled off into squares, the size depending upon the amount of detail

in the original and the degree of exactness required (Figure 7-21). The smaller the squares the more accurate the reproduction. The material for the chart should then be ruled off into the same number, but proportionally larger, squares. A chart whose drawing is to be three times as large as the original copy will be laid off in squares



7-22. An architect's triangular scale.

three times as large. Vertical and horizontal lines should be numbered correspondingly on both original and the chart. These lines now serve to locate corresponding lines and points between the two drawings as the sketch progresses. Some care must be taken in laying out the squares to insure that the lines are accurately spaced and parallel. This is particularly true of the original since an error



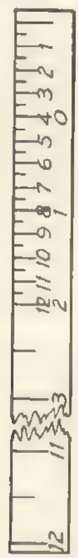
7-23. Fractions of an inch are added at the end of the architect's scale instead of on the rule itself.

here tends to be multiplied with the enlargement on the chart. Vertical and horizontal lines can be drawn quickly and easily on both copy and the chart material by applying the methods described on pages 138 to 139.

The scale method may be used to advantage when mechanical type of drawings are involved which lend themselves to detailed measurement. Either the familiar architect's scale (Figure 7-22) or a home-made scale laid out on a strip of cardboard or wood will

serve the purpose. The triangular architect's scale provides nine different enlargement ratios. It is used by measuring the original drawing with the desired reduced scale and then using this measurement on a full scale to reproduce the enlarged drawing.

For example, if an enlargement of four times is desired, the original should be measured with the portion of the architect's rule marked "¼" and an actual measurement might appear as shown in



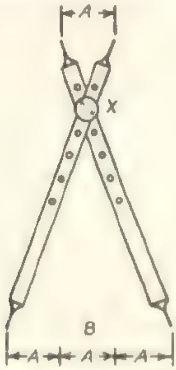
7-24. Enlarging rules to the desired scale can be homemade.

Figure 7-23. The reading here is 6¾, although the actual distance between the points is only one fourth of this amount. If this measurement of 6¾ is now laid out on the chart with a standard rule it automatically becomes four times the size of the measurement taken on the original. Following this procedure throughout the entire drawing produces an accurate enlargement of four times. Note that in using an architect's scale the fractions are measured at the end of the scale rather than at some point along the scale.

Figure 7-24 pictures a home-made scale which is nothing more than an oversized ruler laid out in proportion to the degree of enlargement desired. On one end the standard foot scale has been

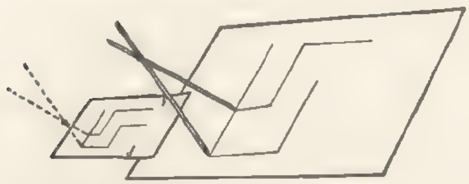
included. The original copy is measured with this and the enlargement made applying the measurements obtained to the enlarged rule.

Proportional dividers may be used to accomplish the same result as the scale without the necessity of reading the measurement. These dividers are a double-pointed device so constructed that a definite ratio always exists between the openings of the two sets of points. This ratio can be varied by adjusting the pivot point "X" in Figure 7-25. The nearer the pivot to the end, the greater the ratio obtained. The dividers illustrated have been set for an en-



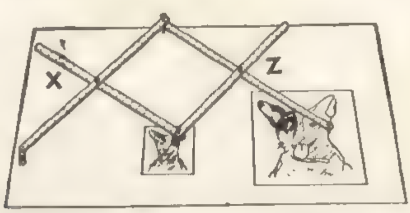
7-25. Proportional dividers are useful for transferring measurements from one scale to another automatically.

largement of three times. The distance between the points "B" will always be three times that between the points "A." When the distance between one set of points is changed, a corresponding change takes place between the other. In operation, the distances are taken off the original with the narrow end and transcribed to the enlargement without further adjustment by the large end. Transcribing all measurements in this way automatically makes an enlargement of the same magnitude as the setting of the dividers. A very simple device of this kind can be made with two pieces of wood bolted together and the ends sharpened to a point or steel points driven in the ends. By drilling a series of holes at given distances a variety of ratios may be obtained. Figure 7-26 pictures one design of proportional dividers easy to construct and satisfactory in use.



7-26. Proportional dividers in use—note enlarged measurement is obtained by merely inverting the dividers.

The pantograph is a simple, mechanical device to aid in making enlargements and reductions by tracing the original drawing. By referring to the illustration it can be seen that the pantograph is anchored at one point (A), the copy is placed under the tracing point (B), and the drawing is produced by a pencil at point (C). The device is operated by placing the hand at the point where the pencil is attached (C) and moving the bars so that the tracing point at (B) follows the lines in the copy being reproduced. The enlargement or the reduction, depending upon the setting of the bars, is automatically taken care of by the mechanical linkage in the device. The degree of enlargement depends upon the position of the pins

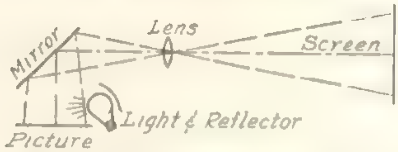


7-27. The pantograph requires little skill to make reasonably accurate enlargements automatically.

(X and Z) in the four bars. Commercial models have the ratio stamped at the proper holes and provide as many as thirty different enlargement ratios. It would be well to notice that the four bars must always be linked so as to form a parallelogram. A pantograph with 21-inch bars will provide a wide range of enlargements up to and including 1–8. It is suitable for making charts as large as 30′ x 40′ and larger if the enlargement is developed in two stages.

The projection method is perhaps the most satisfactory method

of making enlargements and transferring copy for both chart-making and for blackboard drawing. An opaque projector is commonly used for this purpose because most of the material being copied is in the form of pictures or the solid object itself. Photographs, clippings, illustrations in books and magazines, samples of material, and



7-28. Opaque projectors make excellent enlarging devices when the original is small enough to be used in one of these machines.

solid objects can be projected upon any surface in full color enlarged to any degree. When the image is projected upon the blackboard or some chart material, it can be easily and accurately traced producing an excellent enlarged copy of the original.

The distance between the projector and the image projected determines the degree of enlargement obtained. Whenever this

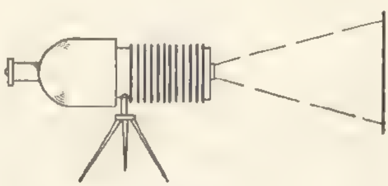
7-29. Enlarging a small sketch for a chart using an opaque projector.

distance is changed, the lens must be refocussed to obtain a clear bright picture. Since the image with this kind of projector is formed entirely with reflected light, the room must be well darkened during the projection. While most opaque projectors will accommodate books and magazines, the area actually projected at any one time is limited usually to a space about 6 inches square. Larger pictures

can be accommodated successfully by dividing the picture into 6-inch squares and projecting them separately. Figure 7-29 shows an instructor preparing a chart by projecting an image of an actual key onto the chart and tracing it with pencil. Whenever the original drawing is in the form of a transparency such as a lantern slide or a negative, the projection can be made with the usual lantern slide projector or a photographic enlarger in the case of negatives. The basic principle of enlargement and transfer remains the same regardless of the equipment used.

How to Finish Drawings

Charts should be drawings tentatively laid out in pencil for flexibility and convenience. It is easy to apply and easy to erase when errors are made and corrections necessary. Pencil drawings,



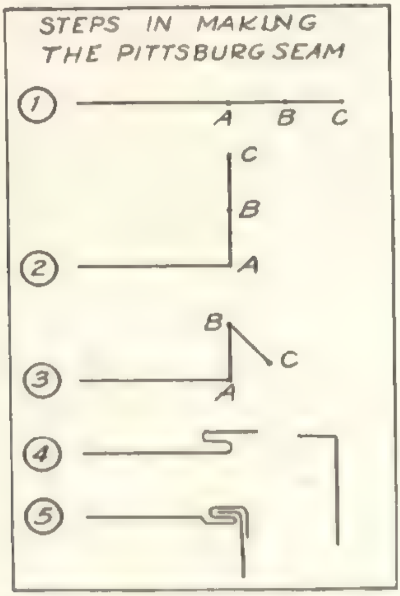
7-30. Slide projectors may be used when the material to be enlarged for the chart is already on a slide.

however, lack the contrast, vigor, and permanence needed for good charts. Several treatments may be used after the pencil drawing has been completed to produce a more finished chart: (1) inked line drawings, (2) inked shaded drawings, (3) opaque colored drawings, and (4) transparent colored drawings. Each method has some special merit when used appropriately and each should be considered before any one is selected for a given chart.

The Inked Line Drawing. Inking a line drawing is perhaps the easiest, and for some purposes the most effective method of finishing a chart. Best results are obtained with very simple drawings, particularly those that do not need to portray depth or a three-dimensional effect. The chart depicting the steps in the construction of a Pittsburgh seam (Figure 7-31) is a good example of the use of the plain line drawing. A more elaborate treatment would quite pos-

sibly detract from the clarity and simplicity of the presentation rather than improve it.

Inking is done with India ink applied by means of pens, brushes, and other inking devices. Before inking a chart, however, the weight (thickness) of line must be decided upon. Line weight should vary with the size and the use of the chart. Selecting the



7-31. A good example of single line drawing for chart use.

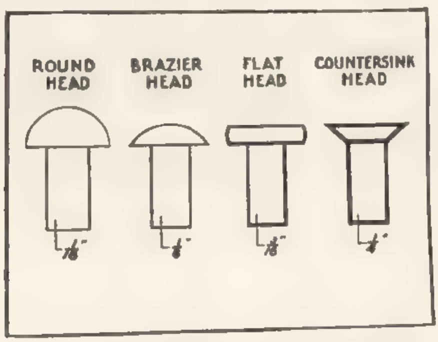
correct size is important and the tendency of all beginners is to use too light a line.

Line Weight. A chart large enough to use before a group of twenty-five or thirty should be inked with principal lines not less than ⅛ inch in thickness, better 3/16 inch, and may even be more satisfactory for very simple drawings if made as heavy as ¼ inch. The distance at which a chart will be viewed determines, in most instances, the preferred weight of line which should be used. The accompanying table lists recommended line weights at various viewing distances.

The importance of choosing a suitable line weight is shown graphically in Figure 7-32. Each rivet on this 22″ x 28″ chart has been drawn with a different weight line demonstrating both extremes of

Distance to Be Viewed (ft.)	*Weight of Average Line (in.)*
4	1/32
8	1/16
15	3/32
25	1/8
50	3/16

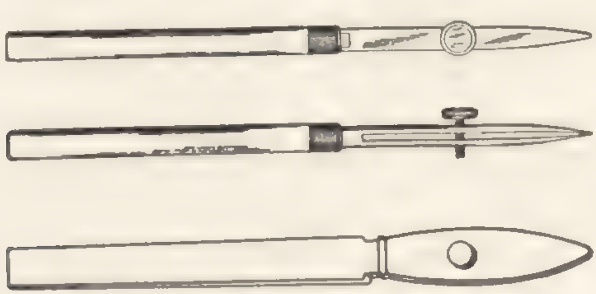
light and heavy along with the more optimum widths. Viewing the illustration at varying distances will aid in grasping the significance of line weight with reference to clarity and visibility in a drawing.



7-32. Chart illustrating the effect of different line weights. (Reduced from 22" x 28" chart)

Some drawings can be improved, or may require, more than one weight of line in order to emphasize certain features and to subordinate others. In this case the desirable basic weight of line should be established first and all other lines made proportional to it. Lighter lines than the principal line will subordinate the parts represented and heavier lines will emphasize.

How to Ink a Chart. Chart drawings may be finished by using



7-33. The ruling pen. The standard type for general use. The "detail" or "Swedish" pen for long and heavy lines.

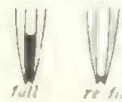
India ink applied in one or more of three ways: a ruling pen, a brush, a striping tool, or a combination of these. The most convenient and commonly used tool for light lines is the ruling pen illustrated in Figure 7-33. The smaller pen "A" is best suited for small lines not exceeding 1/16 inch in thickness and comparatively short in length. The pen shown at "B" is known as a "detail" or "Swedish" pen and is better suited for drawing long, heavy lines; it can draw lines up to 3/32 inches wide, holds more ink, and requires less frequent filling. Either pen is adjustable for the width of line it will draw. Some skill is required to use any ruling pen with success. A little practice and strict observance of the following suggestions will make it possible for anyone to achieve acceptable results.

1. Fill your pen with the quill attached to the stopper, place the ink between the nibs, avoid getting any on the outer sides of the pen.

7-34. Fill the pen by letting the ink run off the quill between the nibs of the pen.

2. Hold the pen *away* from your work while filling.

3. Maintain a uniform amount of ink in the pen as you work from 1/8 to a 1/4 inch; refill frequently.



7-35. Keep ruling pen filled but not overfilled.

4. Try out the pen after filling on a scrap piece of paper and adjust for the proper line width before starting on your work.

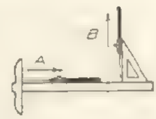
5. Start the pen immediately upon touching the paper and raise it free immediately on reaching the end of the line.

6. Slant the pen in the direction of travel to an angle of 60 degrees.

7-36. Keep pen perpendicular with the paper and leaning 60° in the direction the line is being drawn.

7. Keep the pen perpendicular to the paper at right angles to the line, both nibs of the pen must be touching the paper at the same time

8. Use a guide such as a T square (for horizontal lines) and a triangle (for vertical and angular lines) for drawing all lines.



7-37. Draw all horizontal lines from left to right along the upper edge of the T square. Draw all vertical lines from bottom up with the triangle on the right.

9. Draw all horizontal lines from left to right, vertical lines from bottom up. Reverse the procedure if left-handed.

10. Start inking all arcs, circles, and curves first, then all horizontal lines from top down in sequence, finally all vertical lines working from left to right.

11. Keep the pen moving at a uniform speed; line width varies with the rate of movement.

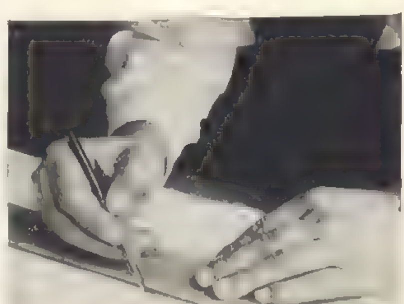
12. Make lines thicker than 1/16 of an inch by drawing two or more adjacent lines.

7-38. Draw wide lines by drawing several adjacent or overlapping small lines.

13. Clean the pen as soon as you are through inking even though only for a few minutes. Use a soft cloth or piece of chamois.

14. Use a good grade of India ink.

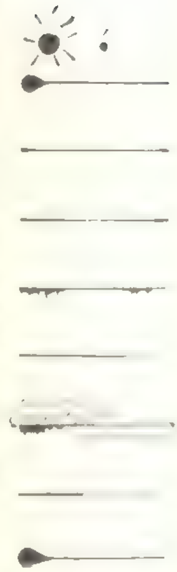
Hold the pen as shown in Figure 7-39. Most pens have a slight recess just above the thumbscrew for the first finger. This will place the adjusting screw away from the operator and in a convenient position to adjust the line width with the thumb and first finger of the hand holding the pen.



7-39. A ruling pen is held like a pencil, slanted in the direction the line is being drawn, and always in a plane at right angles with the paper.

Failures in inking are traceable to a few common faults. If you have difficulty, reread the following cautions and examine the accompanying errors that show the results when caution goes unheeded.

1. Do not fill the pen over your work. Ink may drop from the pen and spoil your work.
2. Do not overfill the pen. The ink may be jarred out of the pen on your work or it will blot when you start to ink a line.
3. Do not allow the pen to rest momentarily on the paper at the start or end of a line. A thickening of the line will result at that point.
4. Do not change the rate of travel as you form a line. Amount of ink in the pen and the speed at which it is drawn both affect line weight.
5. Do not allow pen to tip to side. The line will not be parallel to the guide, a blot may result, or a ragged edge be formed. Both nibs must touch the paper.
6. Do not start a line unless you have enough ink in the pen to complete it.
7. Do not let the pen vary from side to side as you draw a line. It will make a crooked line or result in a blot by causing the ink to run under the guide.
8. Do not let ink dry or lint accumulate on the nibs of the pen. Ink won't flow or ragged line results.
9. Do not attempt to draw too wide a line with one stroke. Opening the nibs more than 1/16 inch may cause the ink to drop out or blot when the pen touches the paper.
10. Don't start to ink a line until you have checked the pen-setting on a scrap of paper.



7-40. Errors resulting from improper use of the ruling pen.

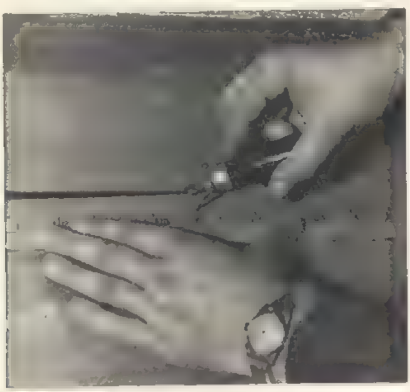
Lettering pens, such as the Edco, the Wrico, the LeRoy, and the Speedball, work well for inking ruled lines. The Edco, Wrico, and the LeRoy are particularly suitable because of the reservoir which holds a supply of ink. These pens are all filled with the usual quill or dropper just as a ruling pen, require less skill to operate, but separate pens must be used for each weight of line.

Ruling pen and brush should be used where real heavy lines or large black areas are to be filled in. Draw in the outer edges of the line or the area to be inked with the ruling pen, then fill in between

these lines with the brush. This gives clean, accurate edges and speeds up the filling-in process.

Striping tools are useful when many large, heavy lines are to be made. This tool shown in Figure 7-41 uses India ink or any standard striping material such as lacquer, poster colors, bronzes, or oil base paint. The material is applied by means of a small, ribbed wheel fed from a small bottle to which it is attached. The thickness of the wheel determines the width of line drawn; they are furnished in several sizes from 1/32 to 3/16 inches. Striping tools can usually be obtained in art supply or sign painters' supply stores.

Brushes are necessary in the finishing of charts for the application



7-41. A commercial type of striping tool that anyone can operate successfully.

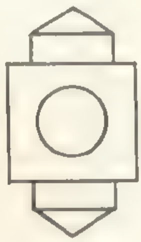
of ink, paints, and lacquers. For background painting, use a fitch brush. These fitches are flat, and they come in sizes ranging from ¼ to 3 inches. They have white bristles, brass ferrules, and long handles and they are well adapted for water-color work. This type of brush is used by scenic painters, as well as by display men.

For small work in ink, japan or oil paints, use Red Sable show-card brushes, in seamless copper ferrules securely fastened to hard-wood, lacquered handles. Use a full-length, high-grade, show-card brush, with a clean, square edge. This is especially adapted for show-card work and it comes in numbered sizes depending upon the thickness of the brush. Sizes range from No. 1 to No. 20—the larger the number, the larger the brush. Genuine Red Sable brushes are expensive. The hair comes from the Russian Tartar marten which

possesses the necessary qualities of softness, springiness, and straightness. For use in japan or oil colors the so-called camel's-hair brush is satisfactory. Camel's-hair brushes are made from the tail of the squirrel, are less expensive than Red Sable, and have not proved satisfactory when used in water color.

How to Shade Line Drawings

Look at the illustration in Figure 7-42 and try to picture to yourself the object it represents. Now look at the drawing of the same



7-42. A line drawing of an object drawn in right-angle projection.

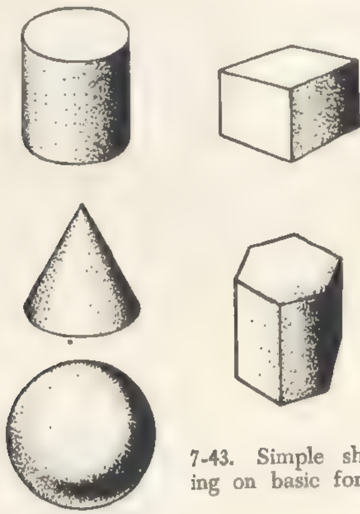
object shown in next Figure 7-44. Is this what you expected it to look like? Both drawings are exactly alike with one exception, the one in Figure 7-44 has been shaded. It is the effect of light and shade on objects that give the characteristic shapes recognized by the eye. This same three-dimensional effect can be given to line drawings by the addition of simple shading. Shading can be produced by two basic techniques, line shading and continuous tone shading. The traditional patent office drawing uses line shading while a photograph or halftone print represents the more realistic tone shading.

The basic principles of shading are relatively simple and few. Most objects are composed of one or more of four geometric forms, the cube, cylinder, cone, and sphere. Learn the basic form of shading for each of these and any object can be shaded with a reasonable degree of success. The simplest procedure is to assume the light is coming from over your left shoulder at an angle of 45 degrees, then:

1. Leave the surface which would normally reflect the most light perfectly clear or unshaded.
2. Shade the remaining surfaces light or dark according to the angle at which the light would strike the surface—as the an-

gle decreases, the surface becomes parallel to the light source, the surface becomes darker.

3. Shade surfaces pointing away from the source of light the darkest.



7-43. Simple shading on basic forms.

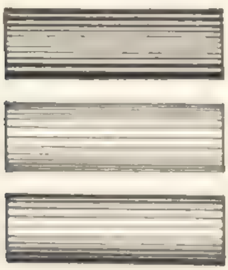
4. Cylindrical surfaces will have the highlight one third the way over from the left side of the cylinder.
5. Conical surfaces will have the highlight from the apex to a point on the base one third the way over from the left side.
6. Spheres will have a highlight spot approximately one third the way down from the top and one third the way over from the left side.

7-44. This is the object shown in figure 42 with simple shading added. Is this the way you pictured it?

7. Shading nearest to or adjacent to a light area will appear darker than that removed from a contrasting surface. This is true even for areas of the same surface. Note that in Figure

7-45. Note how shading gives the sketch a 3 dimensional effect and thus helps the reader to visualize the object represented.

7-45 the edge of the door nearest to the face is shaded darker than its corresponding edge at the back. The knob likewise has its darkest shading not at the extreme lower right hand corner but away from this edge about one quarter of the way in from the lower edge. This same phenomenon will be found in other shapes such as cones and cylinders.



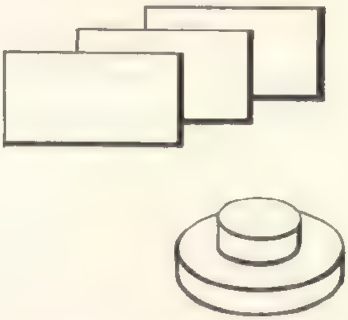
7-46. The effect of shading can be produced by use of lines in three ways (1) changing the weight of line; (2) changing the spacing of lines and (3) a combination of the two above.

Line shading is the easiest and quickest form of shading. It is used exclusively in mechanical and patent office drawing to improve the likeness of the illustration. The same basic principles just described apply equally to line shading and a continuous tone shading as illustrated in the preceding sketches. Line shading gets its difference in tone effect in one of the three following ways:

1. Varying the size of the line or the weight of the line.
2. Varying the spacing of the line of uniform width.
3. Combination of variation in both line weight and line spacing.

The second method of keeping the line width constant and varying the spacing of the lines is the easiest and quickest form of line shading to produce.

A very simple but often effective method of shading is obtained by merely outlining two sides of the object being represented. Usually the two sides selected are the right side and the bottom since the light is generally assumed to come from the left and above. Figure 7-47 illustrates this technique which is particularly suited to represent shadows cast by flat material such as cards or paper.



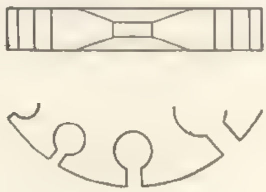
7-47. Three dimensional effects can be obtained for clarity by putting in background shadows cast by the objects instead of shading the object.

Continuous tone shading is difficult to produce but very effective when well done. The simplest media to work in for this type of shading is the pencil, but unless protected by spraying or covering with transparent material it smudges easily. Water colors lend

7-48. Continuous tone shading looks less conventional and more nearly approaches a realistic look.

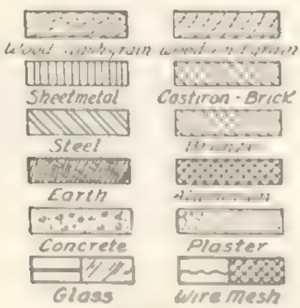
themselves to this work but require considerable skill to use with good results. A simulated effect can be obtained with oil or water paints by graduating the intensity of the color in small steps. Start with the lightest color next to the highlights and gradually add small bands of increasingly darker color as the point of deepest shade is approached. This effect is easy to produce and gives the appearance of continuous shading when viewed at a short distance.

Crosshatching and spattering is a simple but effective method of



7-49. Simple line drawings are sometimes hard to visualize—background may be taken for the object.

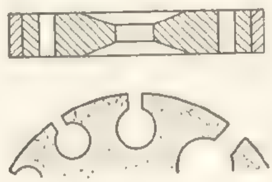
differentiating between adjacent or overlapping surfaces or parts. This technique lacks the third-dimensional quality of tone shading but often clarifies and otherwise confusing line drawing. Look at the sketch in Figure 7-49 then note how much quicker and easier the eye can interpret the same drawing as shown in Figure 7-51. One is a wire gauge and the other a packing gland.



7-50. Standard conventions should be used to indicate the materials represented in line drawings.

Crosshatching such as illustrated in Figure 7-50 is generally used in mechanical drawings and machine drafting. This form of shading is done with a ruling pen, and the spacing of the lines done by eye, measurement, or the use of patented spacing devices. Adjacent parts in a drawing are distinguished by changing the angle of crosshatching. Material from which the object is made can be indicated by the type of crosshatching line used.

Spattering is used to differentiate surfaces or objects as illustrated



7-51. The same line drawing as shown in figure (49) with a form of shading added.

in the sketch of the wire gauge above. This form of shading can be done in two ways. First, by merely dotting the surface with an ordinary writing pen and, second, by means of an old toothbrush. Place a small amount of India ink in a shallow flatbottom dish. Dip the

7-52. An example of continuous tone background put in with an air brush.

ends of the bristles in the ink then hold the brush over the area with the bristles up. Rub a pencil or similar object over the bristles in the direction that will spatter the ink over the paper as the bristles spring back into position. Areas that are not to be covered with the spatter must be protected with a mask of paper or rubber cement. The cement can be rubbed off after the work is complete, leaving the covered surfaces clean.

The airbrush is perhaps the most versatile and effective device for producing shaded effects. The skill and the special equipment necessary place this means of shading out of reach of most teachers. The regular paint spray equipment found in many school shops can be used for some types of background painting and for large areas which are to be shaded. For small work a hand-operated atomizer or the common small blowpipe type atomizer used for spraying a fixative on drawings works reasonably well. Figure 7-52 shows a small card on which the background was sprayed. The pattern was formed by covering successive portions as the surface was sprayed.

Wash shading can be done with water colors by laying successive light washes one over the other, each one receding towards the dark portion of the shading until sufficient density has been built up. Not all papers or surfaces work well with this method because of the excessive amount of water. Be sure the paper is suitable before attempting to use a watercolor wash.

How to Letter Charts

Lettering can make or spoil an otherwise good chart. The teacher who has occasion to letter on a chart does so because a visual aid is needed to help instruct a group or class. Many charts illustrating diagrams, pictures, and schematics need no lettering at all, since the chart is used in conjunction with other aids and the teacher's description. Some charts may require only a few letters, numbers, or simply names of parts and perhaps a title or heading. A few charts may consist of lettering only such as the one shown in figure 7-7, page 133.

Charts illustrating some object may have the names of the various parts lettered directly on the chart (see figure 7-2a, page 121). When this is done it is better to letter the names on, or adjacent to, the parts they represent, rather than in some corner or unused area with a number or code to locate the part it names. Learning is a

problem of association, and anything the teacher can do to make the relationship between a word and what it represents more obvious will speed up learning. This same principle applies in the case of blackboard sketches. Place names as close to or on the part it represents and provide visual association as well as oral. We remember better the thing we see than the thing we hear alone.

Charts which are composed entirely of lettering should usually be laid out in outline form. The material lettered should appear orderly, headings and main points being emphasized by larger or bolder letters. Use topical outline form with letters and numbers. Subordinate the less important items by indentation and smaller lettering. Underlining and use of color may also be used to emphasize important items. These techniques are well illustrated in the two large charts shown in figure 7-7, page 133.

The left-hand chart is a good illustration of a diagram or sketch accompanied by lettering which identifies and describes the sketch.

Regardless of the purpose or use of lettering on any chart, certain general requirements must be observed if the chart is to be useful for group or class instruction. Size, style, spacing, and location are all important if lettering is to be legible and helpful to those who view it. Following are the things one must observe in chart construction if these things are to be accomplished.

Letter size should be large enough so that it can be easily read at the greatest distance at which it will be viewed. Experience and experiment have proved the suitability of the letter heights and line

7-53. A plain well proportioned Gothic letter is the most legible and easiest to letter.

weights shown in the accompanying table for lettering to be viewed at varying distances.

This table holds only for black Gothic letters appearing against a white background with normal spacing between the letters. Figure 7-53 illustrates this type of letter long recognized as the most legible of all letter styles. Condensed or extended letters, extreme thin or heavy line weights, serifs or other decorative features and sometimes

LETTERING FOR CHARTS

Greatest Distance to Be Viewed (feet)	Optimum		Minimum	
	Height (in.)	*Weight (in.)	Height (in.)	*Weight (in.)
3	1/8	1/32	3/32	1/64
8	5/16	1/16	3/16	1/32
15	1/2	3/32	3/8	1/16
25	3/4	1/8	1/2	3/32
50	1 1/4	3/16	7/8	5/32
100	2	5/16	1 1/2	1/4

* Width of line which forms the letter

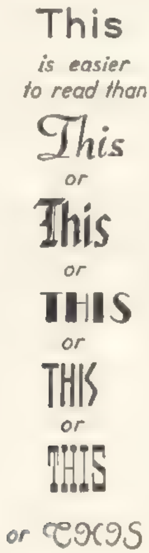
use of color may well reduce the readability of any lettering even to unintelligibility.

For good legibility keep in mind that:

1. Plain Gothic letters are more easily read than fancy ones.
2. Black and white lettering or colored letters on a sharp-contrasting background such as orange and black are better than low-contrast combinations.
3. Normal spacing with the area between the letters as uniform as possible is better than condensed or expanded letters.
4. Letters of a height-to-width ratio of about 3 to 5 are better than extremely thin or extremely wide letters.
5. Line weight should be in correct proportion to the height of the letter. Line weight should increase as the height of the letter increases.

Single-stroke letters can best be done in India ink with one of the several patented lettering pens. The simplest and least expensive of these is the "Speedball" or similar pen points designed to be used in a standard pen holder. The "Speedball" style B, round, is the most suited for Gothic lettering and is illustrated in Figure 7-56. Pens of this type come in a range of sizes indicated by number, such as

the actual line sizes illustrated for the Speedball sizes B-0 to B-6. These pens are best suited for freehand lettering or line work. Their chief advantage lies in the ease with which a wide line can be drawn



7-54. Fancy, bizarre and distorted letter forms destroy legibility and are more difficult to produce.

without variation in width and the uniformly rounded ends produced at the beginning and end of all strokes.

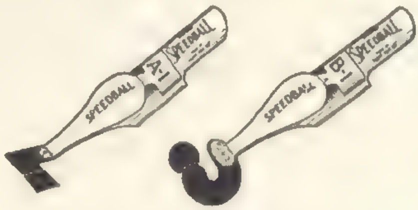
Excellent lettering can also be done by the amateur with the patented adjustable lettering pens, particularly when used with the lettering guides or templates designed for their use. The "Wrico"

7-55. The weight of line used in forming a letter bears a definite relationship to the size of the letter for greatest legibility.

lettering pen is one of this type for which seven different tips are available. This assortment provides seven different line weights for single-line lettering with accompanying letter guides and guides for double-line letters in the larger size for ⅜ and 1 inch letters. These double line letters may be filled in with a brush, thus producing a good-sized letter in solid black.

Lettering Aids

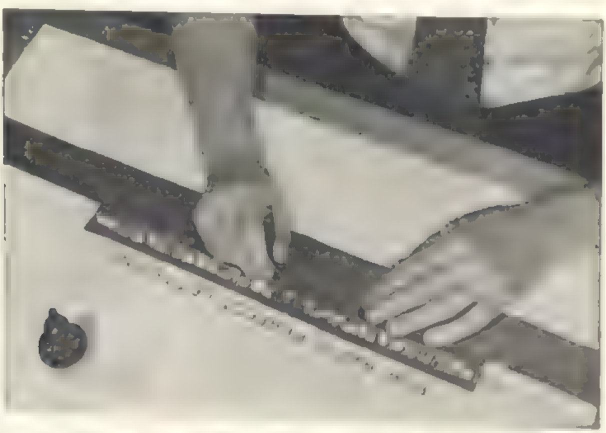
To become a proficient letterer a person must necessarily spend many hours in arduous practice under the guidance of a capable letterer. The teacher who is interested in making his own visual aids has no desire to become a professional letterer. It, therefore, is necessary to acquaint himself with the available types of lettering guides usually sold by art supply stores.



7-56. The "speedball" pen makes uniform line weight easy for anyone.

New-Bone-ite

A very satisfactory type of block art letters is the New-Bone-ite. They are noninflammable, durable, distinctive and have double prongs on their backs. These letters were intended to be used on felt-wall directories and may be purchased in gold, silver, red, or white. If white letters are selected, they may be lacquered the desired color. First remove the prongs from the letters; then smooth



7-57a. Using the "Wrico" pen with a lettering guide (*Courtesy of Wood Regan Instrument Co.*)

down the rough spots on the backs of the letters. Such letters are to be used only for marking out headings or any other necessary lettering.

Two or three of the larger-sized alphabets should be in the instructor's kit, if he uses this form of lettering aid. These alphabets are sold in the following sizes: ¼", ½", ¾", 1", 1½", 2", 2½" and 3". They are made of plastic that should last for years. They will not

7-57b. The "Wrico" is one type of patented pen which produces a uniform weight of line and may be used with lettering guides. (*Courtesy of Wood Regan Instrument Co.*)

break if dropped upon a cement floor, and they will not wear out. The larger letters are suggested as being more practical.

The letters should be placed on the space available and moved around until a suitable layout is obtained. Outline the letters with the long, thin point of a pencil. Afterwards they may be colored with a lettering brush. Great care should be exercised in spacing the letters. Prices range from 3¢ to 10¢ per letter, depending on the size.

Stenso Lettering Cards

Stenso lettering cards are made of oak-tag cards (8½" x 11"). They are numbered according to the size of the letter on the stencil, and they sell for approximately 10¢ per card.

1. No. 12 card contains stencils for a ½″ alphabet with numerals to match.
2. No. 34 card contains stencils for a ¾″ letter, with numerals.
3. Nos. 64-A, 64-B and 64-C contain a complete set of 1½″ letters, numbers and designs. These three cards can be purchased for approximately 50¢ to 75¢.

The larger-sized letters are more practical, since they can be seen from a greater distance. The larger the stencil letter, the less difficulty there is in tracing your copy or heading. "Brushing in" is also much easier.

When painting in your stencil letters they may be more attractive and readable if all parts are joined so that the finished job will not have the appearance of a stenciled letter.

A person can purchase individual stencil letters. These letters come as high as 3 inches or even 4 inches. If a person has difficulty in designing large letters, these cards will be a great aid.

Individual letters may be purchased in several different alphabets such as Roman letters—with a seraph—or several types of Gothic lettering. These letters or alphabets can be bought at any art supply store or a stencil supply house. Directions for their use come with each package.

Hallcraft Display Letters

These are die-cut, cardboard letters of 90-point gauge, or approximately 14-ply thickness. These letters may be obtained in ten colors for display purposes. The colors are white, black, red, blue, yellow, green, orange, brown, bright silver, and bright gold.

These letters can be laid out and stapled down on the background. When letters are stapled down, bend over the staples on the back of the card. The letters can be purchased in various sizes: ¾″ 1″, 1¼″, 2″, 3″.

These display letters come in six, different-style alphabets—three of which are recommended: Gothic, Apex, and Unique. They are all heavy-display types that are suitable for exhibition purposes.

It is advisable to purchase one alphabet in each style. Keep them separate and use them for marking out lettering which may be painted in. Both effort and time are saved by their use

Redikut Letters

Redikut letters come in ten alphabets, only one of which can be recommended—the Kabel letter. These letters are made of very strong newsboard (28-ply). They come in six colors: red, yellow, green, blue, white, and black. They are sold in complete alphabet assortments, including two each of A, I, L, N, R, S; three each of O and T; and four E's. These alphabets also include the symbols: &, $, ¢, making fifty-two characters to an alphabet. They may be purchased in 2¼ inch size and 3 inch size at approximately $1.25 per alphabet.

Redikut letters may be stapled on a display or they may be used for marking out lettering to be painted in by hand.

Gummed-paper Letters and Figures

Gummed paper letters are the perfect answer to the problem in lettering visual-aid material. They are both economical and useful. When mounted properly upon a display, these letters look neat and attractive. They are manufactured in two colors, black and white. They may be made to order in any color selected. Usually most visual aids are made by using either black or white lettering. Such letters, made on thin paper, come in individual packages of ten letters to a package. They are inexpensive and may be secured in various sizes.

The Gothic style letter is recommended for poster and chart use. This style of alphabet is quite visible from any distance and is also easy to lay out and space. No letter smaller than ½ inch is recommended. Letters as small as ½ inch should be put in by hand with a brush or a pen.

The letters described above have gummed backs. In order to apply letters to a background, it is necessary to wet the gummed back of the letter on a sponge or a damp rag and apply it while it is still wet. It is advisable to lay out your lettering on the background in order that no time will elapse between the time letters are moistened and applied. It is suggested that a rag or sponge be dipped into a 50 per cent solution of water and glue in order that none of the glue is removed from the gummed back when it is moistened. This will save much trouble.

The use of gummed paper letters should be encouraged, for they aid an instructor who has little ability in hand lettering. These letters are adaptable for mounting upon lacquered boards or glass.

How to Use Color on Charts

The use of color is a very important factor in planning and making visual aids. Its proper use can make a commonplace thing an object of interest and beauty. However, when color is used without discretion or good taste, it may mar the appearance of an object that would otherwise have been pleasing to the eye.

Contrast

Contrast is the most important factor to consider when using colors. It is through contrasting colors that things can be made attractive. *Example:* If you place a white marble statue in front of a white wall and flood it with a strong light, you will see, no doubt, only the contrasting shadow. This is true if the light surrounds the object evenly. Your failure to see the statue very clearly is due to the lack of contrast. To accentuate contrast, one must add color. If the wall were black in this case and the statue coated yellow, orange or light green, you would have an extreme contrast. Such contrast is often used on the stage, because an effort is made to create a mood, somewhat dramatic and glamorous. Teaching should involve that same showmanship with the aid of visual aids in color.

It is fair to assume that most students need to be stimulated. It is color that will stimulate and create interest to a very high degree. The New York World's Fair was a fine example of stimulation through color. The combination of the buildings when illuminated at night in beautiful and brilliant hues arranged against a subdued but rich blue sky was sufficient to thrill and overawe the average person. Here was a fine example of color contrast—light against dark

Many instructors use some form of mounting board as a background for setting up objects or printed matter. This board might be a neutral tan or dull brown. The mounted objects may be pieces of steel or black-and-white line drawings. This board may have been intended to hang on the wall which is usually cream colored. The result would be rather dull and uninteresting. The reason for the lack of interest is the similarity of cream-colored walls and the

dull brown mounting board. The objects lack color, therefore the result will be unattractive because of a lack of *contrast*.

This situation can be changed, although the wall may remain tan or buff. The mounting board can be painted dark blue. Black panels on the blue may be used for the descriptive matter. The panels should be painted cadmium yellow. If it is a drawing, it can be colored in brilliant light colors because of the dark blue background. The result would be dramatic and interesting because of the contrast in color. Blue is mentioned since nature is always a good guide. It can suggest many pleasing color combinations. For example, a blue sky or the dark green of trees, grass, ivy and moss form beautiful backgrounds.

Color

Since this text is not designed for an art course, the use of colors and their relationship will be somewhat simplified. Terms unfamiliar to the layman will be avoided.

The colors will be divided into three classes:

I. *The Dark Colors*

(1) Black
(2) Blue
(3) Violet
(4) Green
(5) Dark Red (Maroon)
(6) Brown

II. *The Medium Colors*[1]

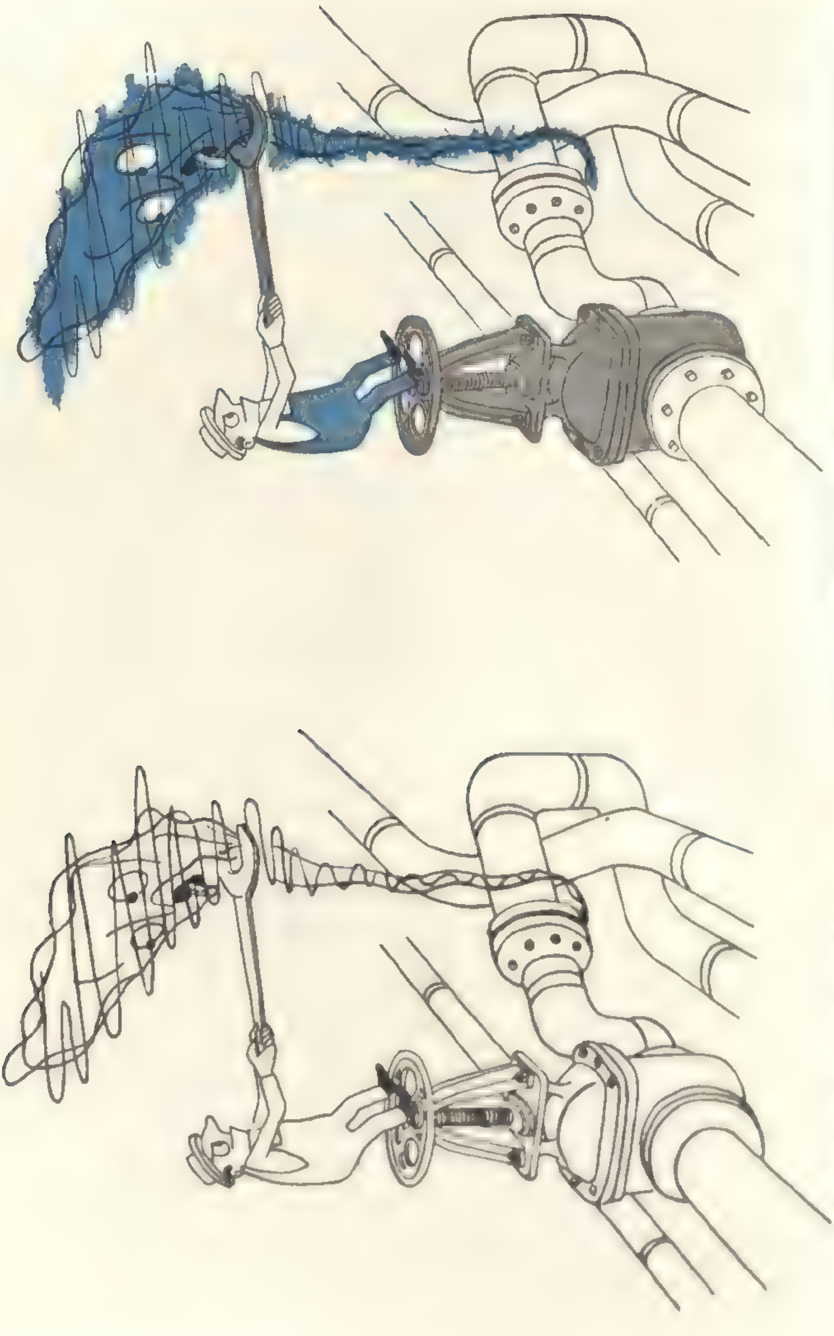
(1) Bright Red
(2) Turquoise Blue
(3) Veridian Green
(4) Magenta (Rose)
(5) Medium Brown

III. *The Light Colors*[2]

(1) Lemon (Chrome Yellow)
(2) Orange
(3) Light Green
(4) Light Blue
(5) Light Gray
(6) Light Brown (Buff, Tan)
(7) White

[1] Any of the dark colors can be made into medium colors by the addition of white to the cold colors and yellow to the warm colors.

[2] The above colors, with the exception of white and yellow, can be obtained by blending any of the dark colors with either white or yellow.



7-58. Color and shading can do a lot for a simple drawing. (Courtesy of Standard Oil Company of New Jersey.)

Rules to Observe When Applying Color

I. Always stir your colors thoroughly before using, to prevent the pigment from dropping to the bottom, resulting in the use of colorless ingredients that remain at the top.

II. When using a cold color for a background, such as dark blue or dark green, the use of a warm, light color will create a very pleasant harmony.
Example—Lemon or chrome yellow on dark blue or green.

III. When using a warm color for a background, such as maroon, violet, dark brown—cold light colors will act as a pleasant contrast.
Example—Light green, white, light blue on maroon, violet, dark brown.

IV. Limit yourself to five or six colors for the background; more often, three or four will produce better results.

V. Lettering should be limited to three colors. In rare cases, for special effects, additional liberties may be taken.

VI. The use of too many colors on a background or in the lettering tend to confuse the reader.

VII. Bear in mind that the lettering carries the message to be conveyed; therefore it must be easily read, properly spaced, contrasted with the background, and legible from the back of the room.

VIII. It is desirable sometimes to use medium colors as a background—such as turquoise blue, bright red, bright green or magenta. Black or white may be used for lettering. Lemon yellow lettering is very appropriate when using cold colors such as green or turquoise blue for a background.

IX. When using medium green or turquoise blue as a background, avoid using bright red for lettering—it will clash and act as a disturbing factor. The same applies to a background of red; avoid using a turquoise blue or medium green for lettering. There is a way of avoiding the above difficulty by outlining and shading your letters with black, and using white as another inside outline around the letter. The above situation should be avoided except where there is no choice. It should be used only for very large lettering.

X. These show-card or poster colors should be at proper brush consistency before using. They should be stirred or agitated constantly and never allowed to settle or dry in the jar. Water *only* should be added. To get the best results the above directions must be followed closely.

XI. Colors evaporate quickly if put into a paper cup or container. Pour color back into glass jar when through using a paper cup.

XII. Always wash the brushes thoroughly with cold water before putting them away.

The Use of Lacquers and Enamels

Lacquers may be used to paint on pressboard, Beaver Board, Upson Board, mason board, or other similar surfaces. It can only be reduced with lacquer thinner. A great many beautiful effects and surfaces can be obtained from the use of lacquer as a background. It is ideal for mounting parts of a machine, with each part painted in a contrasting color; then small cards lettered in another color could be mounted underneath the different parts. This medium will make a beautiful and permanent display, which can be wiped and cleaned with a damp rag.

Enamels can be handled in much the same way, except that enamel is thinned with turpentine. Enamels cost much less than lacquers, but do not look as well.

Lacquers usually dry flat, while enamels have a gloss. Anything that has a gloss reflects light and will sometimes prove to be a source of annoyance in a classroom. Enamel should be avoided unless the flat finish variety can be obtained.

Casein Colors

Colors needed for visual aids are turquoise blue, purple, bright red, lemon yellow, white, and light green. These colors may be mixed with white casein to be made lighter in tone.

Casein colors have the following characteristics:

1. Dry fast.
2. Dry evenly.
3. Most suitable color for backgrounds.
4. Water-color lettering does not pick up background.

5. Water-color lettering covers in one coat.
6. Have a strong pungent odor.
7. Thicken on the brush when used for lettering.
8. May be thinned with water.
9. Settle to the bottom of the jar when left to stand.
10. Spoil in the jar when left to settle for a long time.
11. Harden like cement.
12. Will harden on the brush and render it useless within an hour's time if left unused with paint on it.

Avoid using powdered casein paint—it cannot be controlled on the brush and thickens too fast while being used. Casein paint is best applied with a fitch brush which should be thoroughly washed and cleaned before being put away.

Aniline Dyes

Used commercially by most photographers and display firms, P. P. C. Water Paint, manufactured by Prescott Paint Company, N. Y. C., is sold in bottles and jars full strength; when using add five parts water and one part color. When darker color is desired, use less water and more color. Water added makes the color lighter. It should be applied with lettering brush. Suitable for maps, manufacturers' charts, blow-ups (photo-enlargements). When using aniline colors on blow-ups, always rub ammonia into photograph with a rag before applying color, otherwise the photograph will not take the color in many spots and will create a splotchy coloring job. You will find this type of color the most transparent.

Avoid buying crystal or dry aniline colors—they are messy and difficult to mix because they are uncontrollable. There are many different kinds of liquid aniline colors that are used for air brush and mixed with water—all of them are satisfactory. There are Willers' and Rich-Art also Renaissance water color, sold in all colors; a small 2 oz. bottle cost 45c. It is an aniline color and is sold with a plastic and rubber eye dropper for a cork, that makes it convenient for use. Sold at leading art supply stores.

Mounting

Many times it is desirable to make photographic "blow-ups" of sketches, drawings, and halftones in order to use them as teaching

aids. It is necessary that such prints be properly mounted for use. The following suggestions will be helpful.

1. *Mounting large photographs with paste*

Two thicknesses of paper are used when making large photographic prints known as blow-ups. The lighter weight is preferred when mounting on heavy newsboard or chip-board because it is easier to mount.

The paste may consist of a regular flour mixture, similar to that used by paperhangers; or it may contain a special mixture of half glue and half paste, thinned with water. A specially prepared mixture, in this form, is used by photographers for mounting expensive enlargements, such as murals. This is a preferable mixture for lightweight paper, as it does not contain lumps and melts to a well-thinned consistency. It is also adaptable when double-weight photographer's enlargement paper is used. The regular mixture of plain paste and water may also be used in mounting large, colored sheets of paper on cardboard. Make sure to avoid all lumps.

The photograph which has been taken on lightweight paper should be immersed in a tank of water for a few minutes. It should be removed from the tank while it is soft and spread out upon a flat surface and covered with a thin coating of paste. After the surface has been coated with paste, pick off all the lumps from the surface and allow it to soak for about two minutes. In that length of time, the paper has stretched the required amount and is ready for mounting.

Place the paper upon the cardboard surface and move it around to the proper position. Then hold it down at each end and stretch at the opposite end, brushing out the wrinkles with a short-haired mounting brush. Slight wrinkles in the surface will come out when the paper dries and shrinks to its original size. Use a damp rag to remove surface paste from paper while it is still wet.

This method can be used with a glue and paste combination or with flour paste.

When mounting a large photograph upon a newsboard or other cardboard surface, the side containing the mounted photograph will have a tendency to buckle or warp the card towards the mounted side. This is due to the fact that the photograph was stretched while wet, but upon drying it will shrink and drag the surface of the

board with it. To counteract this condition, a paper of equal weight—such as Kraft wrapping paper—should be mounted on the back of each mounted card. The Kraft paper should be the same size and it should be placed in the same position as the mounted paper or photograph.

2. *Mounted photographs, colored paper or printed matter with rubber cement*

There are several types of rubber cement. "Best Test" is reliable and has given satisfaction.

To mount colored paper, photographs, or any printed matter on a surface, coat the surface of the paper to be mounted with rubber cement and allow it to dry. Also use rubber cement to coat the surface of the cardboard, wood, Beaver Board or any other material to be used for mounting. When both surfaces are coated, allow them to dry. This usually takes about five minutes. When thoroughly dry, the paper is ready for mounting.

To mount the paper, great care must be exercised in first placing down two corners and making sure these are in the correct position. The other corners are then put in their proper position. Do not allow the complete surface of the paper to come in contact with the mounting surface until it is in its proper position. Both the rubber-cement mountings and the surface on which they are mounted must be coated. Once these surfaces come in contact, their position cannot be changed. For that reason, a person must exercise great care in mounting a surface correctly; otherwise the paper to be mounted is usually destroyed if an attempt is made to pick it up after the two coated surfaces have been placed together.

Advantages in using rubber cement are fourfold:

1. It does not warp the paper or cardboard.
2. Surplus rubber cement can be removed easily from the face of the paper, photograph, etc.
3. It results in a neat, clean job.
4. Rubber cement does not discolor paper.

3. *Mounting a heavy card upon another heavy surface*

A star tacker or staple gun may be used. This tacker drives twin-point staples through the two surfaces. The stapler tacks cards,

cloth, paper, and other display material. Tacks may be placed within 1/16 of an inch from the edge, where you cannot swing a hammer. This is a time-saver and a very useful display tool.

When your card is tacked down, turn over the display and cover the staples bent over with Kraft paper tape as a safety precaution. This prevents any scratching of material with which the display may come in contact.

Photographic Enlargements (Blow-ups)

Many times diagrams, line sketches, schematic drawings, and halftones appear in books and other publications. They serve as most desirable teaching aids, if enlarged. The enlargements are sometimes called "blow-ups" and prove particularly useful when finished in color. The enlargement of such material is produced in two ways:

1. If it is a halftone on a very complicated sketch, a photographic blow-up is made. This is accomplished by sending the material to a commercial photgrapher who will enlarge it to the required size. It is then placed on a mounting board after which it is colored in the same manner as a child uses a paint book.
2. If the thing to be enlarged is a line sketch, it is placed under an opaque projector and projected on poster board of the dimensions desired. The size of the enlargement is controlled by the distance between the projector and the material on which it is projected. While the object is being projected, the lines are traced on the poster board with a soft, black pencil. Care must be exercised that every detail is copied. The enlarged drawing is then treated with the desired colors of poster paint. The whole procedure is very simple and requires no special skill to secure attractive results. The procedure in this case is the same one used to produce the pounce pattern explained and illustrated on page 45, Chapter III.

CHAPTER VIII

Projected Teaching Aids

A visually aided presentation is more effective than a completely verbal one. Despite the truth of this statement, it is amazing how many teachers disregard it. It is also surprising the extent of the misunderstandings and wrong concepts which result from verbal instruction unaided by concreteness. In recent years the value of pictures in teaching has been greatly increased by technical progress in many directions, and especially in the field of motion pictures, slide films, and projection techniques. Observation has shown, however, that although teachers appreciate the value of pictorial aids they hesitate to take advantage of them because they do not realize their potentialities and are not aware of the fact that much specialized equipment is available.

Planning and study are as necessary for the intelligent application of these aids as with other methods of instruction used in schools. Unorganized usage is bound to limit the results that can be obtained. Benefits to students and assistance to the instructors are to be found in these media and await only the intelligent selection and use by the progressive teacher.

It is the objective of this chapter to promote better appreciation of the value of projected pictures by pointing out effective ways to employ them in education. This will be done both from the standpoint of efficient use of the equipment and the careful correlation of the aids with the specific topics within the course of study. The degree of effectiveness is dependent on how closely the aids meet the class needs and how skillfully they are handled by the instructor. The use of modern machinery is more efficient in getting results than the use of hand tools. Likewise the use of good educational slides and films is often more effective than most of the older types of classroom instruction.

Although films are valuable instructional aids, one cannot con-

clude that all films are good, and therefore the more films, the better the instruction. There is a possibility of overloading a program with films. A few, well-selected titles may be far better than numerous ones chosen at random. In every case the films should reduce the period of training, produce better-informed students, be an integral part of the educational program; they should not be presented as mere time consumers.

Teaching Advantages of Projected Aids

The advantages inherent in all visual impressions are to be found in the various types of projected aids. "The students can see what the teacher means." Since the majority of ideas must reach the mind through the eyes, each new fact or idea that is visualized aids the learning process. The outstanding features of projected aids may be classified as follows:

A. Better retention of visual impressions.
B. Interesting manner of presentation.
C. Economy of teaching and learning time.
D. Flexibility in use.

A. Mental Retention of Visual Impressions

In many situations it is possible to explain or clarify a subject more effectively by projected pictures than by most other techniques. This is especially true in the following situations:

1. Demonstrations that are impossible because of lack of facilities, environment or expense attached, for example, the making of a stained-glass window or the smelting of copper.
2. Explanation of the function of hidden parts or invisible processes, for example, the function of the parts of a modern bookkeeping machine, or the cracking process in a modern oil refinery.
3. Explanation of theories or abstract principles in the application of scientific laws to the subject under discussion, for example, the atomic theory or the theory of sound waves.
4. Explanation of tools, machines, and equipment by enlarged pictures that will enable a large group to view them at one time, for example, the use of a micrometer, the cutting opera-

tion of a milling machine cutter, the action of a cam on an automatic machine.

5. Acceleration of slow movements and the retardation of movements too fast for the eye to observe and analyze, for example, the acceleration in the growth of a plant, or that in a chemical or physical change; the retardation of a hand or machine movement such as grinding a drill or the action of a riveting gun.

B. Interesting Manner of Presentation

Although the motion picture is universally recognized as a most powerful medium of holding interest, the other forms of projected pictures possess much of the same quality. The use of these techniques presents the subject matter so attractively that ordinary pictorial material is considerably enhanced in value. The outstanding features of presentation are:

1. The extra attractiveness of brilliant light and sharp detail.
2. The co-ordination of sound and sight provides a more varied impression of the material presented.
3. The enlarged picture, graph, or drawing promotes better attention and increased interest.
4. A sense of realism surrounds the picture that closely approximates the real experience.
5. There can be reproduction of scenes and sound effects that otherwise would be impossible.
6. A single glance at a projected picture is many times a greater source of information to the learner than an extended explanation by the instructor. This is true because the relationships are more evident, similarities are recognized, details are clear, and the machine or process is presented as a whole. Furthermore, many learners are visual-minded and experience difficulty in interpreting the spoken word in terms of specific applications.
7. Slides, films, and film strips are usually made by competent persons after careful thought and preparation. The factors of good showmanship are usually employed to a major degree, for example, color, sound, animated sketches, and spotlighting things of particular interest. Because of the interesting pres-

entation, sustained interest is retained over a longer period, thereby delaying or reducing fatigue.

C. Economy of Teaching and Learning Time

Pictures usually save time in making clear that which must be explained by the teacher and understood by the learner. Because of the visual method, time is saved through faster, clearer, and longer-lasting impressions. This economy of time is possible for a variety of reasons when using projected pictures.

1. Pictures usually save time when they are used for illustration instead of blackboard sketches.
2. Drawings may be carefully prepared in advance, preserved, and used repeatedly without further effort.
3. Complicated mechanisms and abstract subject matter are more readily comprehended by students.
4. The student can neither "read ahead" when the teacher dwells on a point nor "look back" at other pictures.
5. Projected pictures permit not only rapid but also numerous changes. In some cases they may be easily and quickly made to meet the changing demands of the subject matter and curriculum.
6. Learning and teaching time is reduced by attracting immediate attention.

D. Flexibility in Use

Because of the process of projection, the same pictures can be used for a few students in a small room or for many hundreds of students in a large hall. They can also be shown in the corner of a room or shop. This great flexibility may be added to the other advantages or projected aids, which are ease of moving and setting up, and the small amount of space required for filing and storage.

The large amount of available material for projection purposes makes it possible to use visual means in many presentations throughout a wide variety of subjects. The extent to which visual aids have been developed is indicated by the long list of movie films, slide films, and slides now available from a variety of sources. (See References, Chapters IX, X, XI.)

Let us pass now from the general advantages of all projected

pictures to the specific characteristics of each medium to be applied to a certain kind of a task.

Characteristics of Each Medium

Glass Slides

Glass slides possess many advantages and serve best when motion is not necessary to the understanding of the topic. The slides have some limitations. These should be presented as well as the advantages in a comprehensive discussion of this kind. The *advantages* are as follows:

1. *Simple equipment.* The projector is very easy to set up, operate, and maintain.
2. *Storage space.* A very large number of slides may be stored in a relatively small space.
3. *Sketches and drawings.* These may be well made with mechanical drawing instruments, the use of which is preferable to freehand blackboard sketches.
4. *Local manufacture.* The simplicity of glass slides makes them very easy to produce as they differ very little from the making of any photographic print. The teacher can make his own slides to supplement the commercial product and show things of local interest to simplify further the instruction.
5. *Expense.* The making of slides of all kinds is relatively inexpensive and the cost may be assumed by the average teacher.
6. *Variable continuity.* The slides are individual units and may be arranged by the teacher in an order that suits his purpose. He can use as many as he desires at any one time. If he is using slides which are a part of an organized series, he can omit those which are of no immediate concern and arrange his own sequence.
7. *Rate of showing.* The rate of showing the slides is under the full control of the instructor. He can stress important points, ask questions, turn back at any time for check-up and review, or spend as little or as much time on an individual slide as he may wish. Some of the projectors are so arranged that a pencil may be used to point out certain features on the

slide. The pencil is projected with the picture and serves the same purpose as a pointer used at a screen.

8. *Utility.* Slides are very helpful during a lecture or discussion to amplify a point or clinch essential facts.
9. *Brilliant illumination.* If a large lamp (300 to 500 watts) is used, it is possible to provide satisfactory projection under daylight conditions in an ordinary classroom. The higher intensities of light eliminate the need for darkening and permit normal procedure in the classroom.
10. *Indefinite use.* The life of the slide is indefinite if carefully used and properly stored. Because of the glass protection there is practically no deterioration.

The *limitations* of glass slides are as follows:

1. *Fragility.* The glass slide is naturally subject to breakage. The tape binding is somewhat of a protection, although the slide may be broken in handling. It also may crack as a result of the heat from the projection lamp if permitted to remain in the machine too long. Simple cooling devices on the later model projectors minimize or eliminate the danger of cracking in the machine. The slide may become unusually hot and therefore very difficult to handle if a cooling device is not provided.
2. *Attention needed for projection.* Although the projector is simple to operate, the slides must be placed in the projector in the right position. Slides may be arranged in about eight positions, but only one will provide correct showing. This requires the careful attention of the operator.

   To eliminate all difficulty, a thumb marker should be placed on each slide. This is a small, white, gummed strip with a red dot at one end. If the label is fixed in the proper position, the operator's thumb will be on the dot when inserting the slide in the machine with the right hand, and the slide will be in the proper position for correct projection. The title or number of the slide can be printed on the white portion of the marker.
3. *Lack of motion.* Obviously slides are a disadvantage if motion is essential to the understanding of the subject matter

This particular limitation, however, should in no way discourage the use of slides. There is a limitless amount of subject matter that may be placed on slides that does not involve motion for complete understanding.

3¼" x 4" Glass Slide

This is the oldest form of projected teaching aid. It has many uses and may be made with a minimum of difficulty by the average teacher. The construction will vary according to the facilities available and the purpose for which it is to be used. Detailed instructions for making it will be given in a later chapter. At this point it will be described to show the various kinds of glass slides.

a. The most common types are made of glass with the picture printed directly on the glass (photographic plate). In this type, a positive plate must be made from the original negative. The emulsion side (sensitized) of the glass is covered with another piece of clear or cover glass. The two pieces are called a "sandwich" and are sealed with tape on all four sides and thereby produce a slide.

b. Another type and one very easy to make is produced by drawing the object on finely etched (frosted) glass. It is backed with a piece of clear glass and sealed as in the foregoing type.

c. A very satisfactory color slide may be made by placing the drawing on etched glass and adding color by the use of special crayon or colored ink. With proper care and patience the colors may be blended and shaded to produce very attractive results after a minimum of practice.

d. A cellophane slide is to be preferred when it is desirable to project typewritten material. The typing is done on a specially prepared cellophane and then bound in a sandwich of two pieces of clear glass.

e. There are times when it is desirable to project things in silhouette form. In this event the paper silhouette is prepared and then placed between glass and sealed as before.

f. It is sometimes desirable to make combinations of the types mentioned for specific purposes, for example, a pencil sketch and typing on cellophane or a pencil drawing and a silhouette. The variety is dependent on the cleverness of the teacher.

Every teacher should learn how to make slides of the types just

described since they may be used in teaching all school subjects.[1] They are particularly adaptable to vocational and technical subjects in which many sketches and technical data are involved. Typical examples of their utility in mathematics, science, and safety are as follows:

8-1. Kit for making hand-made slides. *(Courtesy Keystone View Co.)*

1. *Mathematics and Mechanical Subjects*—geometrical drawings, diagrams, graphs, formulae, types of screw threads, and many things ordinarily placed on the blackboard. The typed cellophane slides may be used for questions, special problems for solution, and technical vocabulary.
2. *Science*—drawings explaining scientific principles, cross sections of plants, animals, mechanical devices, and diagrammatic sketches. Cellophane slides may be used for scientific data, tests, formulae, and special problems.

[1] Kit for Making Homemade Slides—Keystone View Co., Meadville, Pa. (See Figure 8-1.)

3. *Safety and Health*—cartoons, diagrams, graphs of accidents, and diseases. Cellophane slides for slogans, wise sayings, proverbs, spot tests. (See Chapter XV for discussion and illustrations of 3¼″ x 4″ projectors.)

Making the Hand-Made Slide (3¼″ x 4″)

It is not difficult for teachers to learn the making of hand-made slides to satisfy the needs of their particular subject. There are four basic types to be made, although it is possible to make combinations of the several kinds. The most common are:

1. A lead pencil drawing on etched glass.
2. A drawing colored with crayon on etched glass.
3. A drawing colored with special ink on etched glass.
4. A piece of cellophane carrying the typed copy and placed between two pieces of clear glass.

Holder for Making Hand-Made Glass Slides

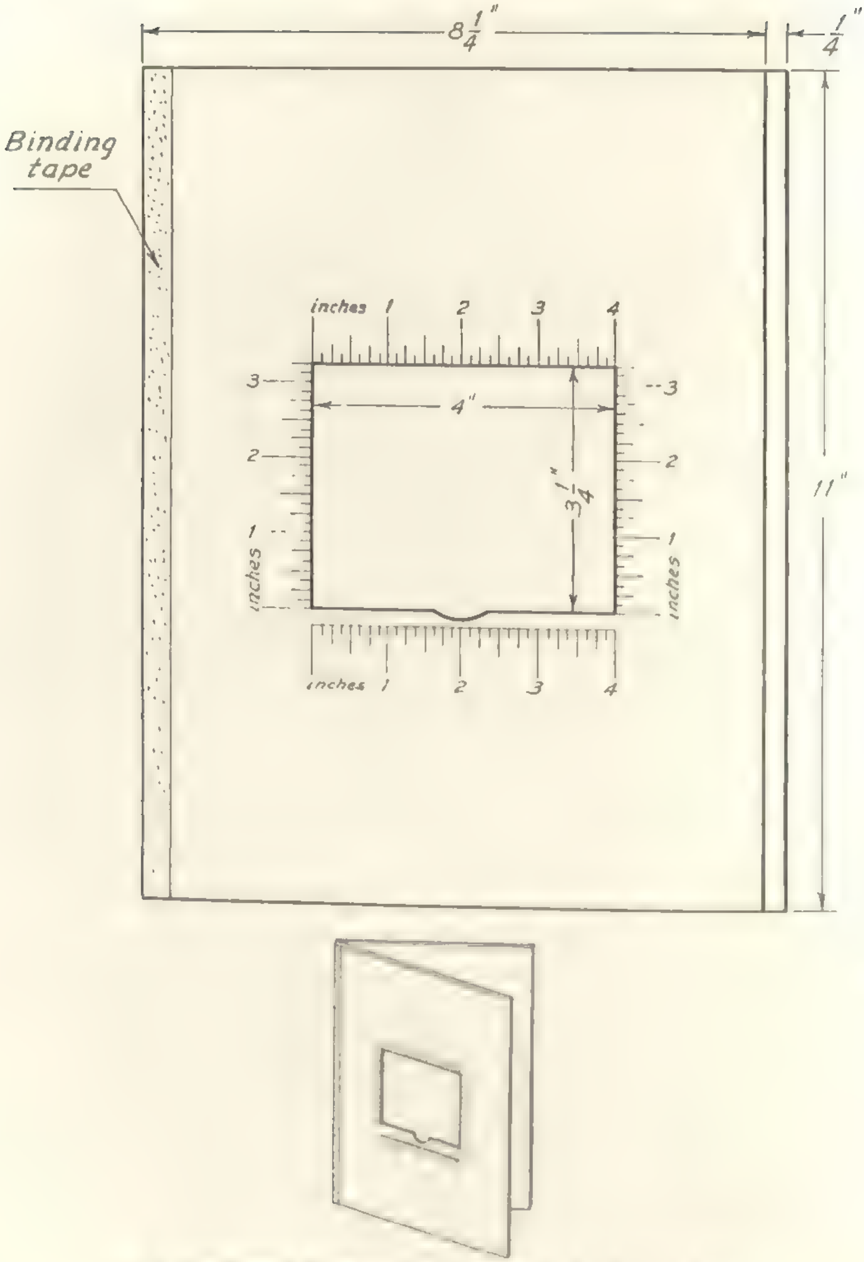
The holder illustrated (Figure 8-2) is necessary for convenience and accuracy when making hand-made slides. Although it is possible to purchase holders of a similar type, it is very easy to make this one by following the directions below.

Materials

1 cardboard—8½″ x 11″ x 1/16″
1 cardboard—8½″ x 11″ x 1/16″ or more
Scotch or other binding tape, ¾″ or 1″ x 12″

Procedure

1. On the 8½″ x 11″ piece of cardboard lay off in the center a space 3¼″ x 4″ as shown below.
2. With a sharp-pointed knife cut out the 3¼″ x 4″ section.
3. Cut out thumbnail arc as shown.
4. Rule scale markings on all four sides as shown.
5. Hinge two cardboards together at left edge with Scotch or other reliable binding tape.



8-2. Cardboard holder for use in making handmade slides

There are various materials used for making slides. The more information known about these materials, the better will be the results of their use. It is well to absorb this knowledge before proceeding with the task of slide making.

Etched (ground) *Glass.* Although there are various grades of etched glass available, the fineness and evenness of the etching should be the determining factor in the selection of the grade to be used for hand-made slides. Coarse and uneven etching, such as is obtained by acid etching or sand blasting, will make it difficult if not impossible to secure clean-cut line projection and evenly blackened or colored areas. Mud ground glass with its fine and evenly ground surface will greatly simplify the work and enhance the results. Thickness should be between 16 to 18 lights per inch.

Plain (cover) *Glass.* There are also various grades of cover glass as well as etched glass. However, the means of determining the grade to use is more difficult in the case of covers.

All clear glass does not make a satisfactory cover when cut to proper size. Slide glass, whether etched or plain, must be properly annealed so as to withstand the close range heat of a 500-watt lamp. Properly manufactured slide glass will stand projection for an unlimited period of time, while cut window panes and other random cut sheets will crack within a few seconds or a few minutes. It is wise to purchase all slide glass from those specializing in materials for this specific purpose. Thickness should be between 16 and 22 lights per inch.

Crayons (colored). Special crayons have been developed for hand-made slide work. These are manufactured with a minimum amount of oil binders to prevent run from heat and will project colors as truly as possible in the face of the intense light encountered in projection lanterns. Common colored pencils may be used for coloring, but the resulting projected colors will not be satisfactory.

Pencils. Any medium-soft lead pencil may be used for hand-made slide work. For fine-line work, a 3 or 4 H will be necessary as the etched glass quickly removes the sharpened point.

Inks (colored). When it is desirable to have more brilliant color projection than it is possible to achieve with colored crayons, there are available special inks which may be used. Particular care is necessary, however, since it is difficult to control the flow as the

inks tend to follow the etching. Proper consistency is important and may be obtained by leaving bottles open, if too thin, and by thinning with "solvent" if too thick. Inks are used only when brilliant color projection is desired and generally on small area work. A heavy pencil border of the area to be covered will assist in controlling flow. White projection is obtainable only through the use of white ink.

Cellophane. Amber-colored cellophane is the best material to use when making slides for typewritten material. Cut to slide size and, inserted between double-faced carbon paper, typed copy can be applied without difficulty. Amber is suggested to reduce glare during projection.

Carbon Paper. Clean carbon paper is an absolute necessity for clean-cut projection of word copy. A single piece of carbon paper should never be used more than once. Special red carbon paper, which is available and cut to the proper double size for slides, is recommended.

Binding Materials. Common *passe partout* is generally used for binding the two parts of a slide. If a slide is to be a permanent addition to a slide file, it should be bound on all four sides. If it is only for temporary use and the glass is to be cleaned and reused, it is necessary only to bind with a short piece at each end.

Special Scotch Tape is sometimes used for binding. However, since the sticky edges sometimes cause one slide to stick to another in the files its use is of doubtful value.

Cleaning Materials. To remove crayon—use soap and water. To remove lead—use a special preparation for this purpose. It will remove pencil marks without damaging the etched surface. Most abrasives will remove pencil marks, but many will ruin the etching and reduce the number of times a piece may be used. To remove inks—use ink "solvent." The same material is used for thinning.

Hand Made Slide Project 1

Purpose: To learn the use of etched glass as a medium for the projection of sketches, charts, procedures, etc., on a classroom screen for large classes.

Materials Needed

Glass slide holder
No. 2 black pencil
No. 3 black pencil
6″ rule

Problem: To make a slide of an outline drawing with simple shading.

Procedure

1. Place original drawing squarely on the bottom board of slide holder underneath slide opening of top board.
2. Place etched glass in the opening of top board.
3. Trace outline of figure with finely pointed No. 2 pencil.
4. Shade and retrace outline to insure clean black projection.
5. Trace border lines with finely pointed No. 3 pencil taking care to keep them as narrow as possible. Use pencil with a slight turning motion while tracing and thus insure even width of line. Sharpen the pencil after each line is traced. Use rule for guide.

Caution: Erasures cannot be made on etched glass. Each over-run and under-run will be highly magnified when projected on the screen. Be certain that your pencil is properly placed before moving.

6. Binding Slides—Place a piece of clear glass over the etched glass with the working surface to the inside. Then, bind the two pieces of glass with a strip of *passe partout* binding tape.

   Materials Needed

   15″ strip of *passe partout* binding tape
   2 pieces of slide glass, unbound

   Operations

   a. Place two pieces of glass together evenly.
   b. Wet from 1½″ to 2″ on one end of the tape.
   c. Holding the glass together firmly, center one-half of one long side on the one end of the wet side of tape. Press down.

d. Wet the balance of the tape.

e. Turn the end of the glass onto tape with special care to keep it centered on width of tape.

f. Complete turning of glass until all four sides are covered and ends overlap.

g. Press finger along each edge to see that the tape is pressed tightly to all four surfaces.

h. With thumb and finger, press edges of the tape to the glass surfaces on all four sides leaving corners open.

i. Turn each corner down neatly to overlap and seal. It may be advisable to trim the surplus tape in lieu of overlapping.

j. Place each surface flatly on the table and press over all taped surfaces to make certain that there are no loose sections.

k. Paste a thumb marker in the proper position and print the title of the slide on the marker.

Note: Special binding devices are available that expedite this binding operation.

7. Place a thumb marker on the slide in the proper position and print the title of the slide on the marker.

Hand Made Slide Project 2

Purpose: To learn how to use colored crayons when making an etched glass slide.

Materials Needed

Glass slide holder
Colored crayons
Etched glass

Problem: To color outline drawing so that a solid, even color projects on the screen.

Procedure

1. Lightly color the open areas of the sketch with sharp, pointed crayon taking special care to work color up to the border lines.
2. Go over the entire area with circular motion of crayon working as close to the borders as possible without over-running them.

3. Again go over the area with a horizontal motion and again with a vertical motion.
4. Examine your work by holding it before a window or place it in a projector. Look for areas that are not covered, also be sure that the color is evenly distributed over the entire surface.

Caution: Crayons have a minimum of oil binder and are, therefore, brittle. Sharpen often so that material will work into etching but do not exert severe pressure.

Hand Made Slide Project 3

Purpose: To learn the use of inks in the making of etched glass slides.

Materials Needed

Glass slide holder
Bottle of special slide ink
Etched glass
Ball point pen

Problem: To cover a restricted area, keeping ink within proper boundaries for clean-cut projection.

Procedure

1. Make several designs (at least six) on glass with pencil borders of varying width and density. Have at least one design an eighth-inch circle, one a small triangle and one a square.
2. First apply the smallest amount of ink possible in the center of the largest figure. Watch the spreading tendency.
3. Proceed with applications allowing for spread. After completing each figure, project the result in order to see whether you have secured a complete coverage and solid color. Then proceed, taking advantage of any errors in application.
4. Following this practice exercise place your drawing in position and with a clean piece of glass proceed as in the previous cases and finally use the special inks in the correct color.

Caution: If the ink is too thin, spreading will be extremely rapid. If too thick, it will be difficult to apply. A proper consistency is of the utmost importance.

Hand Made Slide Project 4

Purpose: To learn the use of cellophane in making typewritten slides.

Materials Needed

Cellophane
Carbon paper
Clear cover glass
Binding tape

Problem: To place typewritten copy on cellophane so that a clear, clean-cut projection of each letter is shown on the screen.

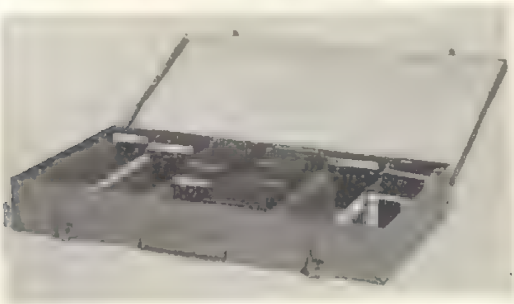
Procedure

1. Fold carbon paper so that when doubled it is the same size as a slide glass.
2. Drop a piece of cellophane into fold with care. Be sure it fits squarely within the carbon.
3. Feed the combination into the typewriter with folded edge *down.*
4. Run through to leveling bar and level with precision.
5. Turn to *three* spaces.
6. Set carriage so that the first letter will print three spaces in from the left edge.
7. Type copy by giving each key the same pressure (generally poor results will be obtained by using the touch method, since little finger letters will not project as clearly as others). Type no line longer than *three* spaces from the right hand edge of paper. Type no line lower than *three* lines from the bottom. The limit will be 32 spaces wide and 15 lines deep.
8. Remove cellophane from carbon paper, place between two pieces of clear glass. Temporarily bind each end with one inch of binding tape and project for inspection.

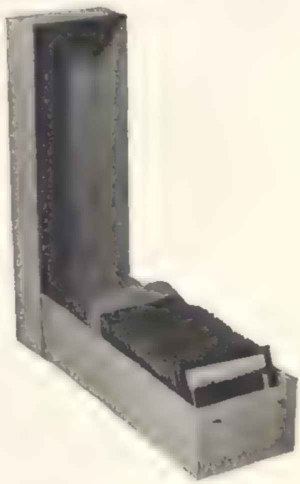
Caution: Place the paper in the machine squarely. Hit each key with the same pressure. Inspect the keys to see that they are clean. It is not necessary to "throw out" typewriter ribbon, but it will save wear and tear if you do so. Type slowly and carefully as strike-overs and all other errors will be magnified on the screen.

2″ x 2″ Glass Slide

This form of slide is being used very extensively and has replaced the 3¼″ x 4″ type for certain purposes. They will not replace the larger slide entirely. In this case, the scene, drawing, cartoon, etc., must be photographed with a 35-mm film camera and from the negative a positive must be made which, in turn, is bound between two pieces of clear or cover glass (2″ x 2″) for projection. (See



8-3. Metal storage box for 2″ x 2″ slides with "indexing" form in the lid.



8-4. Metal sequence box to accommodate slides for immediate use.

binding of 3¼″ x 4″ slides.) The advantages and limitations of 3¼″ x 4″ slides are inherent in the 2″ x 2″; however, the latter has certain advantages and may be purchased commercially in a greater variety of subjects.

This slide is smaller and requires less storage space for relatively the same number of 3¼″ x 4″. It is possible to secure satisfactory metal storage boxes of the type shown in Figure 8-3. The sequence box shown in Figure 8-4 is also available and most convenient for carrying a series of slides to the point of projection for a specific lesson or lecture.

Steps in Making 2″ x 2″ Slides

Copying a Picture or Drawing on 35-mm Film

Equipment and Material Needed

1. 35-mm camera with copying attachment.
2. Copying stand with lights.

3. Electric exposure meter.
4. Scale or ruler.
5. Masks.
6. Weights.
7. 35-mm positive film.
8. Drawings or pictures to be copied.
9. Small mirror.

Procedure

1. Determine the number of pictures to be taken according to the requirements of a pre-arranged lesson plan.
2. Load the camera with the proper amount of film.
3. Attach the camera and copying attachment to the copying stand. (Be sure that the copying attachment is absolutely parallel with the baseboard.) (Figure 8-5.)
4. Arrange the pictures or drawings according to size.
5. Place one picture on the baseboard. (The picture must be absolutely flat. Use weights if necessary.)
6. Adjust the lights so that they will illuminate the picture at about a 45-degree angle or at an angle that will produce even illumination over the whole surface without glare.
7. Move the focusing attachment into place.
8. Focus for sharpness and composition. (It may be necessary to mask the picture in order to exclude unwanted material and to secure the best composition.)
9. Measure the distance from the ground glass to the lens in inches. Square this distance and divide by four. Your answer will be the exposure factor.
10. Place a white card on the picture.
11. Set the exposure meter for the proper film speed and take a reading from the white card.
12. Choose a diaphragm stop (not less than F.8) and multiply the exposure by the exposure factor in order to obtain the correct exposure.
13. Set the camera for the correct shutter speed and diaphragm opening.
14. Slide the camera into position over the lens.
15. Wind the shutter and make the exposure by pressing the cable release.

16. Advance the film.
17. Slide the camera out of position.
18. Repeat the above procedure and copy the remaining pictures.
19. Remove the film from the camera.

8-5. Home-made copying stand showing copy in place, properly masked and ready to be "shot."

Developing 35-mm Film

Equipment and Material Needed

1. Developing tank (adjusted to 35-mm size).
2. Thermometer.
3. 16-oz. graduate.
4. Film clips.
5. Two sponges (flat).
6. Timer.
7. Developer (D-11).
8. Hardener (optional).
9. Acid hypo.

Procedure

1. Check developing tank to see that it is properly adjusted to 35-mm size.
2. Check developer and hypo for proper temperature. Solutions should be 65°F.
3. Turn off lights and load film into the reel and place the reel into the tank.
4. Replace cover on tank and turn on the lights.
5. Pour 14 ounces of developer into a glass graduate.
6. Set the timer for 6 minutes. Pour the developer into the tank and start the timer.
7. Agitate the film by moving the tank every 1½ minutes.
8. At the end of 6 minutes or when the timer rings, pour the developer from the tank into the graduate.
9. If a hardener is used, pour about 14 ounces into the tank and allow it to remain for about 5 minutes. Then pour it out.
10. Pour 14 ounces of acid hypo into the tank and let it remain for about 15 minutes. (Agitate the tank frequently.)
11. At the proper time pour the hypo from the tank into the graduate.
12. Remove the cover from the tank and remove the reel.
13. Place the reel under running water at 68 F. for about 15 minutes.
14. Return the solutions to their proper bottles.
15. At the proper time, remove the reel from the washwater and remove the film from the reel.

    CAUTION: Handle the film by the edges only. Place a clip at one end of the film and hang it up.
16. Wash out the sponges and squeeze them as dry as possible.
17. Pass the sponges over both surfaces of the film at the same time and remove the excess water.
18. Place another film clip at the bottom of the film for a weight and allow the film to dry.

Binding and Masking 2″ x 2″ Slides

The proper slide-making accessories must be secured before attempting to bind black-and-white negatives and positives. These are 2″ x 2″ cover glass, binding tape, and masks. The cover glass

with ground edges can be purchased in quantity from a photographic supply dealer.

The negatives or positives are cut from the film roll after they have been developed. Each single frame is then bound between two pieces of thin glass known as "cover" glass. If it is desirable to cover portions of the slide not used by the image or to obliterate undesirable portions of the image, a mask should be used. These masks can be obtained for large- or small-sized slides. Those for 2″ x 2″ slides have an opening of 24 x 36 millimeters or 25 x 40 millimeters. The mask should be held open and the film inserted with the emulsion or dull side up. Place the mask holding the film between two pieces of cover glass after all dust has been removed from the film. Unroll about three inches of binding tape, moisten the tape, and place the slide on the gummed side of the tape. While the glass is held tightly, the tape should be rolled along the glass edges until three sides are covered. The tape is unwound from the roll during this procedure and pressed along the top and over the sides of the first edge covered. This operation should be continued on the succeeding sides. When the fourth side is completed, cut the tape and remove the excess at each corner thereby making a mitered joint. When completed, it is neat and dustproof. At this point a marker or thumb spot should be placed on the slide at the lower left corner where it is held so that the picture is viewed as it should appear on the screen. When placing the slide in a projector, the right-hand thumb covers the spot on the marker when the slide is placed in the slide holder. The label is large enough to accommodate the slide number and title (Figure 8-6).

Kodachrome Slide

Although the kodachrome slide is 2″ x 2″ and not unlike the 2″ x 2″ slides discussed above, it is distinctive because of its color. The color not only adds to its attractiveness, but enables the student to view things in their own natural setting.

The colored film is more expensive, but it is relatively cheap when the results are considered. The original cost is approximately $2.50 for an eighteen-exposure roll. This price includes the developing or "processing" by the manufacturer, which makes the film ready for projection. When the individual pictures are cut apart

and mounted between cover glass, the cost is less than 20¢ each. The Agfa Company placed on the market during 1945 a color film that needs no processing by the manufacturer. This film has great possibilities for extensive use as the amateur may complete it in his own home darkroom.

These slides are made in the same way as described above, with the exception that the original or negative film is used without making a positive. The film may be placed in a "sandwich" between

8-6. Glass slide showing thumb marker.

two pieces of cover glass or the negative film may be placed in a cardboard mount made specially for this purpose. This latter procedure is not so satisfactory as it leaves the film exposed. Unless considerable care is exercised in handling of the cardboard mounted film, it will become covered with fingerprints which decrease the amount of light passing through the film and sometimes allows the fingerprints to be projected on the screen.

Opaque Projection

The opaque projector is probably the simplest and least expensive of the various devices for projection purposes. It is designed to

project any kind of nontransparent flat surfaced matter. Its effectiveness is based on the reflective power of mirrors and consequently the projected image is not as bright as in the case of transparent glass slides. A considerable amount of light is lost through the reflection process and therefore the room in which opaque objects are projected should be as dark as possible in most situations. It is possible to use the opaque projector without complete darkness, which is a distinct advantage if students are expected to make notes of their observations. This may be accomplished by using a short-focus lens and placing the projector a minimum distance from the screen which will produce a picture of satisfactory size with concentrated illumination.

This type of projector is a most useful but many times a much neglected device. The reluctance on the part of teachers to capitalize on its potentialities is no doubt due to two things: first, they do not know how to operate it; second, they fail to realize how useful it can be and how many laborious hours of blackboard writing and sketching it will save. It is most suitable for instructional purposes because it is "still projection" and permits ample opportunity for close observations and discussion. Furthermore, it is useful for group study of limitless pictorial material not otherwise available in transparencies. Material from textbooks, reference books, post cards, and other printed matter may be used for instructional purposes and may be typed or printed for projection purposes. (See Chapter XV, Equipment for Visual Aids Center, for discussion and illustrations of opaque projectors.)

There is practically no limit to the range of educational subjects that may be presented by it at a very nominal cost. It is particularly adapted to the presentation of printed tables, diagrams, charts, and pictures whether on separate pages or pages in a bound book. In addition to the projection of flat surface material it is also feasible to project such things as milling cutters, gears, tools, gauges, and small mechanisms such as a watch, micrometer, light meter, etc. Furthermore, it must be remembered that all these things may be projected in their natural color—just as they appear to the eye but greatly enlarged.

This device is so simple that teachers and pupils find no difficulty in learning its operation. It is possible that the surface of material placed in the projector may be affected by the heat of the

lamp if care is not exercised. Paper will curl and become scorched after a prolonged period and the projected image may become distorted. A piece of well annealed plate glass laid over the picture will prevent this difficulty.

Advantages of the Opaque Projector

1. Materials provided by the students as well as the teacher can be shown to the entire class in a minimum of time.
2. The teacher's personality and teaching ability are paramount in the use of the opaque projector. The pictures without the teacher would be of little value educationally.
3. The possibilities of this type of projection are unlimited due to the extensive material available for projection purposes.
4. Still pictures permit adequate time for observation and discussions.
5. The cost involved is practically negligible. A wealth of material is to be found in magazines, newspapers, house organs, manufacturers' pamphlets, and publications of trade associations.
6. The individual teacher can build up his own file of material to meet the needs of his particular subject.

Suggestions for Use

1. When introducing new subjects, pictures of the equipment and processes, if studied carefully and interpreted in relation to the student's work, will contribute greatly to the understanding.

2. Draw diagrams, graphs, sketches and mechanical drawings with black India ink on white 5 x 8 cards of a good grade.

3. Mount photographs or other book or magazine illustrations on 5 x 8 cards of a contrasting color to increase their eye appeal.

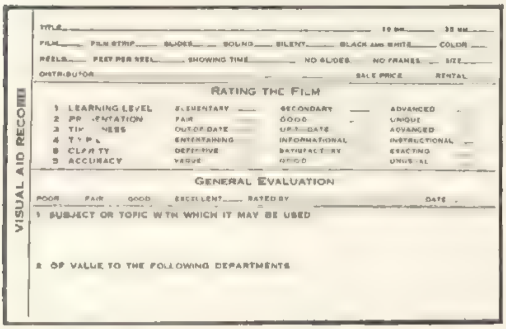
4. Use file cards as per suggested in Figure 8-7. The notations on the back will save time on repeated use.

5. A display of the various items on the bulletin board prior to projection will create curiosity, interest, and anticipation. Such a display after projection will aid in the retention of the facts learned.

6. Photographs or line drawings without captions may be used to stimulate student observation and identification. Symbols used by architects, electricians, radio mechanics and mechanical drawing conventions may be taught in this way.

7. Paste the illustrations to be used on a roll of suitable paper in order that they may be drawn through the projection area as wanted. This is not only a convenient arrangement but it prevents the loss of valuable material. This technique permits the orderly presentation of an entire topic or subject.

8. A very desirable alternate plan to the preceding suggestion is the mounting of the material on suitable cards. The cards may be arranged in the required sequence and fastened together with



VISUAL AID RECORD

TITLE ____ 16 MM. ____ 35 MM. ____

FILM ____ FILM STRIP ____ SLIDES ____ SOUND ____ SILENT ____ BLACK AND WHITE ____ COLOR ____

REELS ____ FEET PER REEL ____ SHOWING TIME ____ NO. SLIDES ____ NO. FRAMES ____ SIZE ____

DISTRIBUTOR ____ SALE PRICE ____ RENTAL ____

RATING THE FILM

1 LEARNING LEVEL	ELEMENTARY	SECONDARY	ADVANCED
2 PRESENTATION	FAIR	GOOD	UNIQUE
3 TIMELINESS	OUT OF DATE	UP TO DATE	ADVANCED
4 TYPE	ENTERTAINING	INFORMATIONAL	INSTRUCTIONAL
5 CLARITY	DEFECTIVE	SATISFACTORY	EXACTING
6 ACCURACY	VAGUE	GOOD	UNUSUAL

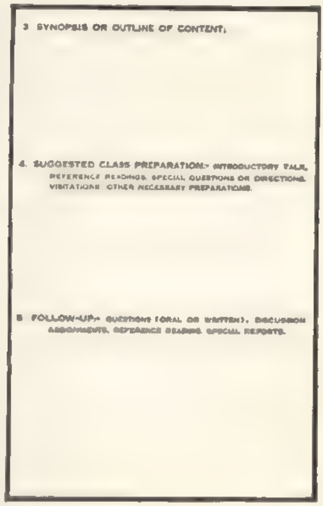
GENERAL EVALUATION

POOR ____ FAIR ____ GOOD ____ EXCELLENT ____ RATED BY ____ DATE ____

1 SUBJECT OR TOPIC WITH WHICH IT MAY BE USED

2 OF VALUE TO THE FOLLOWING DEPARTMENTS

8-7. Card form for permanent record of pertinent information concerning films and slides which have been used.



3 SYNOPSIS OR OUTLINE OF CONTENT:

4. SUGGESTED CLASS PREPARATION:- INTRODUCTORY TALK, REFERENCE READINGS, SPECIAL QUESTIONS OR DIRECTIONS, VISITATIONS, OTHER NECESSARY PREPARATIONS.

5 FOLLOW-UP:- QUESTIONS (ORAL OR WRITTEN), DISCUSSION ASSIGNMENTS, REFERENCE READING, SPECIAL REPORTS.

Scotch Tape or masking tape. The resulting accordian effect is very convenient to handle.

9. Tracing paper, glass slides, cellophane, or other transparent plastic materials are good for line sketches to be projected. When using one of these media, a piece of white paper should be placed under them to give contrast and consequently clearer projection.

10. Small objects particularly flat ones may be magnified by opaque projection so that a whole class may see them. Larger objects may be projected on the screen by the use of a projection box shown in Figure 8-8.

11. When a number of facts, formulae, or other items are to be projected, but it is desirable to present them one by one, a masking plate of the proper style should be used. This arrangement will focus student attention on one thing at a time.

12. Student work may be projected, when found desirable, for criticism and correction.

13. Some demonstrations may be projected for all to see in which case the response is much better and the subject matter is understood with greater clarity, for example the lines of force surrounding a magnet may be easily shown. This is done by placing a bar magnet on the bottom of the hinged platen. A piece of stiff cardboard is

8-8. Opaque projector stand for use when projecting three dimension objects.

placed over the magnet and the iron filings when sprinkled on the cardboard as it is tapped will arrange themselves according to the magnetic field of the bar. Also the action of a compass when brought in close proximity to a magnet may be shown as well as many other experiments.

14. It is possible to show chemical reactions by projection, if placed in shallow dishes.

15. The association of symbols and meanings may be effectively presented, for example the pictures of a number of tools or other

items may be mounted on a card including a printed or typed list of the names. The students may be requested to associate the names with the corresponding item. It is also possible to use a like procedure for test purposes, especially when using the true false, completion or multiple choice type of test.

16. It is feasible to place a book under the projector but the results may leave something to be desired. It is usually not possible to have the page of the book perfectly flat in which case part of the page will be out of focus.

17. The opaque projector is very useful when conducting a conversation or discussion lesson, for example the picture of an intricate machine or other mechanism may be thrown on the screen for the explanation of its operation and use.

18. A great deal of time is saved by projecting anything that would be examined ordinarily by each member of the group.

The projected teaching aids described in this chapter have great possibilities in the hands of alert, resourceful and professionally minded teachers, supervisors and directors.

References

Distributors for Slides (Kodachrome 2″ x 2″)

1. Society for Visual Education, Inc., 100 E. Ohio Street, Chicago 11, Illinois.

Distributors for Slides (Standard 3¼″ x 4″)

1. Keystone View Co., Meadville, Pa.

Reproductive Processes

1. *Basic Photography*, U. S. Army Technical Manual #1-219, Washington, D. C., Superintendent of Documents.
2. Bernsohn, A., *Developing and Enlarging*, New York, Ziff-Davis Publishing Co.
3. *Copying*, *Eastman Kodak Data Book*, Rochester, Eastman Kodak Co.
4. Fraprie, Frank K., *How to Make Lantern Slides*, Boston, American Photographic Publishing Co.
5. Hamilton, G. E., *How to Make Hand-Made Lantern Slides*, Meadville, Pennsylvania, Keystone View Co.
6. *Instructions for Making Positive Photographic Films for Reproducing Ozalid Poster Prints*, New York, Ozalid Corporation.
7. Neblette, Brehm and Priest, *Elementary Photography* (Making Enlargements), New York, Macmillan Co., p. 156.

8. Neblette, Brehm and Priest, *Elementary Photography* (Slide Making), New York, Macmillan Co., p. 170.
9. "Opaque Projection in the Schoolroom," *National Elementary Principal*, June 1934, pp. 330-5.
10. Price, W. T., *Demonstration of Techniques for Making Slides in Color*, National Education Assn., Washington, D. C., 1934.
11. *Slides, Eastman Kodak Data Book*, Rochester, Eastman Kodak Co.
12. Taylor, J. Y., *Opaque Projection*, Buffalo, Spencer Lens Co.

CHAPTER IX

Slide and Motion Picture Films

Slide Films or Film Strip

The film strip is a roll of film consisting of positive images produced by direct printing from the negative print. The individual pictures are placed in the desired order and printed on 35-mm safety film.

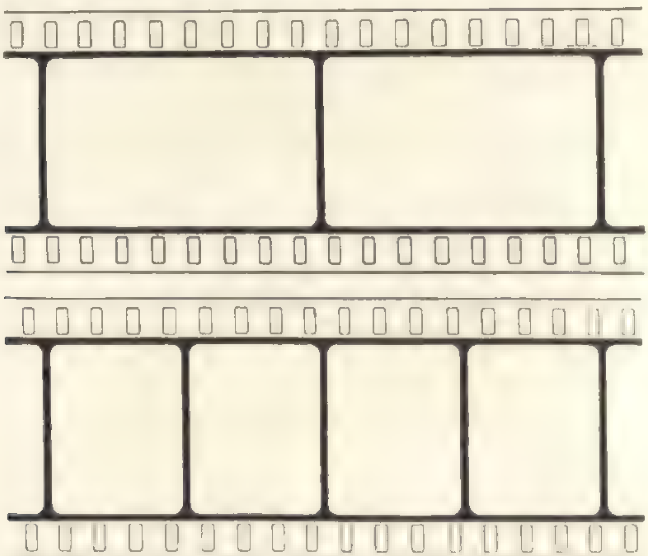
It was introduced about 1920 and was first used in schools and churches. Its value as a medium of training and education was discovered later by industrial plants and government agencies. Its greatest importance was realized during World War II when it was used in every phase of the military training program from instruction in the use of radar to that of handling of landing craft. The pictures may be single or double frame. The former is ¾″ x 1″ and the latter 1″ x 1½″. (Figure 9-1.)

The single frame is most commonly used and the majority of slide film projectors are made for its use. The single-frame picture appears in the film with its width (1″) across the film strip while the double frame appears with its width (1½″) along the film. This means that the single-frame film may be run through the projector in a vertical position while the double frame must be passed through the projector in a horizontal position. There are projectors available with a swivel head for the projection of both types of slide film. It is probable that more of the double-frame film slides will be used as teachers tend to make their own slides. This is due to the use of the 35-mm cameras available for making the original or negative prints. There will be a further expansion in the use of the double-frame slide films as teachers increase the use of kodachrome film. Because commercially produced slide films are readily available and are convenient to transport, use, and store, they are replacing individual slides.

Slide films are now available from many sources. Manufactur-

ers, professional organizations, and film producers are distributing film strips for educational, advertising, and propaganda purposes. The film is placed in small, suitable tin cans for transportation and storage. In some instances they are produced in sets or series. Figure 9-2 shows a set or kit of such films on the subject of woodworking. The Jam Handy Company was one of the originators of this medium of training and is now one of the biggest producers.

There are two types of film strip in general use—the silent and the sound which have advantages in common.



9-1. Shows the difference between a single- and double-frame slide film.

1. *Simplicity.* This advantage pertains to the use of slide films in an even greater degree than the glass slides. The operation is limited to turning a knob to change the pictures.

2. *Rigid continuity.* There is no possibility of the pictures getting out of sequence as they are joined together on a single strip. This may or may not be an advantage.

3. *Low cost.* They are inexpensive from the standpoint of equipment maintenance and materials.

4. *Compactness.* The film rolls are small and can be stored in small tin containers.

Satisfactory slide film projectors are shown in Figure 15-10, page 316.

Special Characteristics of Silent Slide Films

Advantages

1. *Absolute continuity and extreme simplicity.* There can be no disturbance of the proper sequence of either the pictures or the explanatory notes as they are all joined together on the film. Once the film has been threaded in the projector, there

9-2. A series of slide film on Safe Practices in Woodworking. (*Courtesy of JAM Handy Co.*)

   is no further operating procedure except to turn the knob to change the pictures. In every factor—cost, simplicity of handling, and ease of operation—silent slide films offer outstanding advantages.
2. *Controlled pace.* The teacher may go as fast or as slowly as he desires. He can skip through frames which hold no immediate interest or he can hold one as long as needed for study or additional explanation.
3. *Films can be turned back to review one or two preceding frames because the projector is reversible.* It can be turned on and off at will and the presentation of the film can be interrupted and supplemented as desired.

Limitations

1. *Limited dramatization* is a natural result of the lack of motion and sound.
2. *Results are particularly influenced* by the way the films are presented. Poor reading or use of irrelevant explanatory material will be detrimental to the effectiveness of the films. On the other hand, proper preparation and presentation will avoid this difficulty.

It is not to be assumed that the making of a slide film is an easy task. The results will leave much to be desired unless uniform lighting conditions prevail. In some cases, like outdoor scenes, this is not too serious, but if a series of photographs are to be "shot" for a strip film the photographs must be of the same quality and the light intensity must be the same for each succeeding frame or the results will be most disturbing when compared with a professional job.

The making of home-made strip film is not recommended unless the teacher is thoroughly familiar with photographic processes.

There is an abundance of strip film material available through commercial producers and through industrial concerns who have had films made explaining how their products "work" as well as the science or mechanics on which the machine operates and how the material was developed. The training programs of the last war have left with us many slide films that are not too highly specialized to be used in our regular vocational and technical school curricula. If the fixed position of the frames in a strip film is unsatisfactory, it is possible to cut the pictures or frames apart and mount them as individual 2″ x 2″ slides.

It has become common practice to issue with a slide film a guide or teacher's manual which supplies information that may be used to supplement the pictures and thereby increase the value of the film as a teaching aid. Some slide films carry titles and commentary on intervening frames that explain the pictures. The best techniques in using this type of material will be discussed in the chapter devoted to the use of different teaching aids. At the end of this chapter will be found the names and addresses of companies handling slide films.

Special Characteristics of Sound Slide Films

The sound slide film has all the characteristics of the silent film except that there are no captions and commentary. The explanation of the individual frames is placed on a 16-inch disc rotating at 33⅓ revolutions per minute and synchronized with the picture. A program of 15 to 20 minutes is possible while using one side of the record. In this event the teacher is replaced entirely by the recording.

The machine used is a combination slide film projector and record player. (See Figure 15-11, page 318.) These machines are very compact and convenient and range in price from \$65 to \$85. A satisfactory substitute for the combination machine is a simple slide film projector and a separate 33⅓ rpm turntable. The same results may be obtained, but it is not as convenient as the portable machines illustrated. There are some things to be said pro and con about the sound film.

Advantages

1. *Rehearsed oral accompaniment.* Since sound films are shown with an accompanying record, their effectiveness is heightened and insured through the use of trained voices especially rehearsed for the part before the picture is "shot."
2. *Increased interest.* The use of voices, music, and sound effects makes it possible to stimulate additional interest through greater dramatization. Where voice, music, etc., are a part of the subject of study, the auditory stimulus takes on additional value.
3. *Films can be used without the records.* After a film has been used with the record to give a general over-all view, it can then be shown without the record for amplification of specific points, for questions, review, and check-up. Under this kind of usage the film assumes the advantages of the silent slide film. The rate of showing and explaining is under the control of the teacher and not governed by the record.

Limitations

1. *The presentation rate is controlled by the tempo of the record.* This advantage can be largely offset by the use of the film

without the record as just mentioned. However, during the course of regular showing, since the film must be turned in synchronization with the record, a picture cannot be held for study unless the record is stopped. This can be done on some machines, but it involves the danger of losing synchronization and requires some practice to perform the operation properly.

2. *Synchronization is dependent upon the operator.* Since the proper timing depends upon the operator's hearing the signal from the record and moving the film accordingly, it is possible to lose synchronization if the operator's attention is distracted or if he is hampered by extraneous noises. However, if he is familiar with the film being shown, he can quickly recover any loss of synchronization.
3. *Continuity is more difficult to follow.* Because of any number of reasons, a student may miss a few important phrases which will affect his understanding of the whole film. Generally, sound slide films move faster than silent ones, and, furthermore, there arise problems of proper amplification. If the sounds are too loud, too soft or distorted, the understanding of the film will be affected accordingly.

The sound slide film has been widely used for instructional purposes, but the fact that the teacher does not have control of the situation makes it less desirable for many kinds of instruction. This objection may be removed by eliminating the record. The sound film, however, is most effective for teaching such things as safety, co-operation, and a wide variety of personnel problems. Industry and business leaders are very enthusiastic about the sound slide film for "putting across" proper work attitudes and employee-employer relationships. It is not only possible but probable that films of this type will be developed in the near future for use in habit and character training throughout the public schools.

Slide Film Projector

The operation of a slide film projector may be learned in less than a half hour. These machines, regardless of the manufacturer, operate on the same principle. Small sprocket wheels fit into the perforations on the sides of the film and by a knurled knob on the end of the sprocket shaft the film is indexed from frame to frame

If funds are available it is advisable to purchase the single-purpose machine for film only. It has few parts to contend with and it is always ready for use. These machines are made in different sizes and with lamps ranging from 100 to 300 watts. The larger machines provide most satisfactory projection in a space that will hold several hundreds of people while the small machines with a 100- or 150-watt lamp will be adequate for the average classroom. Various kinds of slide film projectors are illustrated in Chapter XV, Equipment for Visual Aids Center.

Motion Pictures

"The thing we call a motion picture, which is not a picture of motion at all, has been in existence for countless ages. That is, the principle of the motion picture has been known to mankind for three or four thousand years. Historical records indicate that in ancient China there were devices which produced the effect of motion perceptible to the eye. It was a far cry from those early attempts to produce the illusion of motion to the development of the motion picture film which is used so extensively for education and entertainment today. However, the ancient and the new depend upon the same psychological phenomenon for the illusion.

"Psychologists tell us that an image on the retina of the eye remains there approximately one-twelfth of a second after the object itself may disappear from view. This is known as 'persistence of vision.' If we can arrange, therefore, to remove one picture, and substitute another similar picture within the period during which vision persists, we can view the pictures with a feeling of continuity just as we do the motion picture today. The pictures are changed on the screen at the rate of sixteen times per second when silent films are used, and at the rate of twenty-four times per second when sound pictures are used. The result is a smooth continuity of the series of still pictures placed so closely together that the eye travels from one to the next without noticing the break or change. The ordinary motion picture reel, therefore, is made up of a series of 16,000 separate and distinct still pictures which are closely related, and are projected on the screen within a period of ten to fifteen minutes."[1]

Since these early beginnings great technical progress has been

[1] Dent, Ellsworth C., *The Audio-Visual Handbook*. Society for Visual Education, Inc., Chicago, pages 101-102.

made in the production of motion pictures and they have become one of the most potent forces in the world for teaching, entertainment and propaganda. Their use and importance will continue to expand as new techniques of production are developed and new applications made. The experience of the military authorities during the last war will serve as an inspiration and guide for further use of motion pictures in education and training.

Kinds

While motion pictures are available to schools in both 16-mm and 35-mm sizes, there are so many factors involved in the use of the 35-mm film and equipment that we shall not deal with them here. In many places the use of 35-mm film in schools is prohibited except under conditions of operation and supervision which necessitates the services of professional technicians. This type of film is usually made of nitrate of cellulose and, although it is not explosive, it will flare and burn easily if exposed to intense heat. Its pliability and transparency recommend its use. Where such technical services are available to the school, the teacher cannot only take advantage of the use of 35-mm film but will have also a source of expert advice on projection of other kinds. See Figure 9-3 for a comparison of size.

Although the 16-mm film did not make an appearance until long after 35-mm films were produced, the smaller size is much more widely used in schools today because of the advantages of lower cost, lighter equipment and easier operation. It is noninflammable and made from acetate of cellulose. If exposed to intense heat, it may blister and eventually burn slowly.

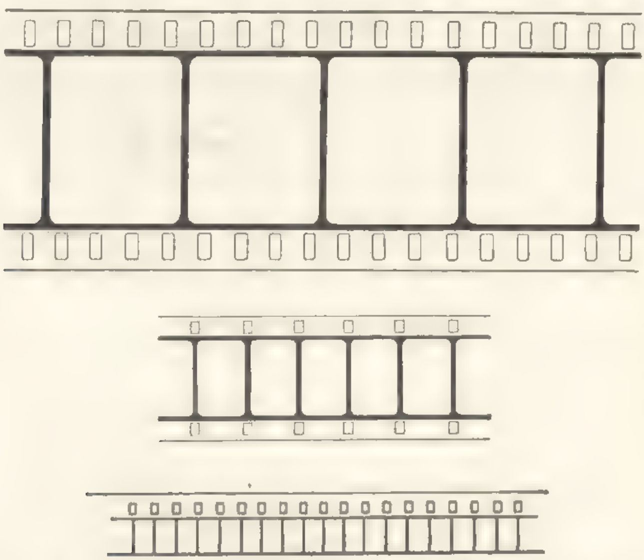
It is highly probable that 8-mm film will come into more general commercial use in the near future. Although it is now used for amateur work only, the improved films and lenses of recent date will hasten its wider use.

Silent Movie Film—16 mm

A standard reel holds 400 feet and takes about 10 to 16 minutes to project, depending on whether or not it is sound or silent. All explanatory notes are printed on the film. Commercial productions are taken with 35-mm cameras and reduced to 16 mm when printed. The film, when being projected, is given a rapid intermittent motion

as it passes the light in the machine and consequently this motion appears to be continuous on the screen.

There are 16-mm projectors that are not much larger than slide projectors and their operation is almost as easy, especially the later models. Threading the film into the projector preparatory to showing is the principal skill that must be acquired and this can be done easily with a little practice. These projectors usually have lamps of 500 to 1000 watts to insure adequate illumination.



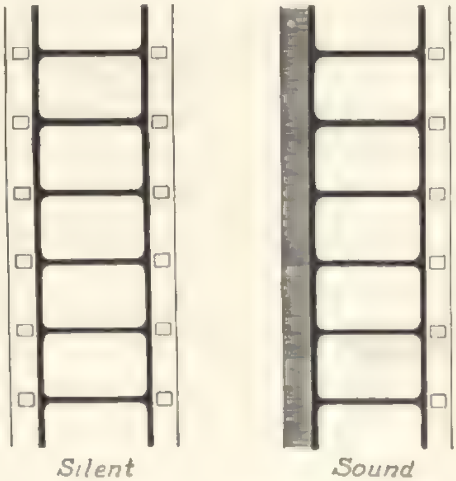
9-3. Showing the comparative size of 8-, 16- and 35-mm film.

Sound Movie Film—16 mm

This film has a sound track which makes possible an oral accompaniment and the use of music and other sound effects. While similar in construction to that of a silent projector, the sound machine has the additional apparatus needed to produce sound from the track on the film. This makes the projector considerably higher in cost, somewhat heavier, and a little more difficult to operate. A part of the additional equipment used for the production of sound is the loud-speaker with an extension cord so that it may be placed near the screen. See Figure 9-4 showing the difference between a silent and sound film. A sound film is projected at a speed one-

third faster than a silent film, therefore a 400-foot reel will provide a show of only 11 minutes.

IMPORTANT NOTE—A silent film may be run on a sound machine but the reverse is *not true*. If an attempt is made to run a *sound film* on a *silent machine* the *film* will be *ruined*. The sound film has only one set of sprocket holes with the sound track on the opposite side of the film in lieu of a second row of sprocket holes.



9-4. Showing the difference between a sound and silent 16-mm film.

Advantages

1. *Movement.* This, of course, is the main feature which distinguishes this medium from the previous ones discussed. Where movements and actions of any kind are an important part of the subject, the use of motion pictures is of unparalleled value.
2. *Intense interest.* This is a direct result of action added to picturization. There are a vast number of motion picture films about people, places, events and things which can be used for study or as background material in practically every subject.
3. *Unlimited effects.* Motion pictures can make inanimate things come to life. That which is imaginary and hypotheti-

cal may be given a visual presentation. They can combine two or more complicated motions and they can speed up or slow down motion at will. Animated technical drawings offer limitless possibilities as aids in technical subjects.

Limitations

1. *Greater costs.* As might be surmised, all of the cost factors involved in motion pictures are higher than those for still pictures. This applies especially to sound motion pictures.
2. *Greater care in showing,* in setting up, operating and servicing motion picture equipment. Here, again, these limitations apply more to sound equipment than to silent because of the greater complexity of the equipment. However, these difficulties are not serious but are merely mentioned by way of comparison with "still" projection and to make the point that a little more practice is necessary to attain proficiency in handling.
3. *Fixed rate of presentation.* This means that the teacher does not have the advantage of controlling the amount of time spent on each picture or phase of the presentation. Usually the film cannot be held or turned back conveniently for students who need additional explanation before going further.
4. *Required darkness.* The motion of the pictures, in addition to the fact that only part of the projector's light actually reaches the screen, and the intermittent interruption during the projection process make a greater degree of darkness necessary.

Polarized Pictures

A discussion of this type would be incomplete without a mention of the motion pictures now in development which are viewed through polarized glasses. This form of picture is beyond the experimental stage and before long may be in general use. This film viewed without the special glasses has such a cloudy and fuzzy appearance that it is annoying. A complete transition takes place when the glasses are used. The picture takes on a depth and reality that is astounding. The people take on life and the audience gets the impression or sensation as it would from a stage show where the living actors are present.

The third dimension created by the polarized picture will add greatly to the value of pictures as a learning medium. These pictures are taken by two synchronized motion picture cameras and projected by two synchronized motion picture projectors. The same stereoscopic principle is involved in the production of these motion pictures as that used in the taking of pictures for use with the stereoscope.

The developments in this field should be followed closely by educators so that this new equipment will be used as early as possible in education. Motion pictures of this type have not been produced for showing in public theaters because of the difficulties and inconvenience involved in the necessary use of the individual polarized glasses.

References

Distributors of Films

1. Association Films: 347 Madison Avenue, New York 17, New York, 19 S. LaSalle Street, Chicago 3, Illinois; 351 Turk Street, San Francisco 2, Cal.; 1700 Patterson Avenue, Dallas 1, Texas.
2. Castle Films, Division of United World Films, Inc., 30 Rockefeller Plaza, New York 20, New York.
3. Coronet Instructional Films, 919 N. Michigan Avenue, Chicago 11, Illinois.
4. DeVry School Films, 1111 Armitage Avenue, Chicago 14, Illinois
5. Encyclopaedia Britannica Films, Inc., 20 N. Wacker Drive, Chicago 6, Illinois.
6. Jam Handy Company, General Motors Building, 584 Broadway, New York City.
7. Knowledge Builders, 625 Madison Avenue, New York 22, New York.
8. Official Films, Inc., 25 W. 45th Street, New York 19, New York.
9. Teaching Films, Inc., 88 Lexington Avenue, New York 16, New York
10. Vocational Guidance Films, Inc., 2718 Beaver Avenue, Des Moines, Iowa.

Distributors of Slide Films

1. Castle Films, 30 Rockefeller Plaza, New York 20, New York
2. Jam Handy Company, General Motors Building, 584 Broadway, New York City.
3. Popular Science Publishing Company, Audio Visual Division, 353 Fourth Avenue, New York, New York.
4. Society for Visual Education, Inc., 100 E. Ohio Street, Chicago 11, Illinois.
5. Visual Sciences, Suffern, New York.

Books

Adam, Thomas Ritchie, *Moving Pictures in Education.* Moving pictures in Adult Education, New York, American Assn. for Adult Education (Studies in the Social Significance of Adult Education in U. S. A.), 1940.

American Council on Education, Commission on Motion Pictures in Education. Pam. Free 1943, *Other Americas Through Films and Records.*

American Council on Education Studies, Motion Picture Project, American Council on Education, Washington, D. C. *Motion Pictures in Education: Status and Needs, 1937.*

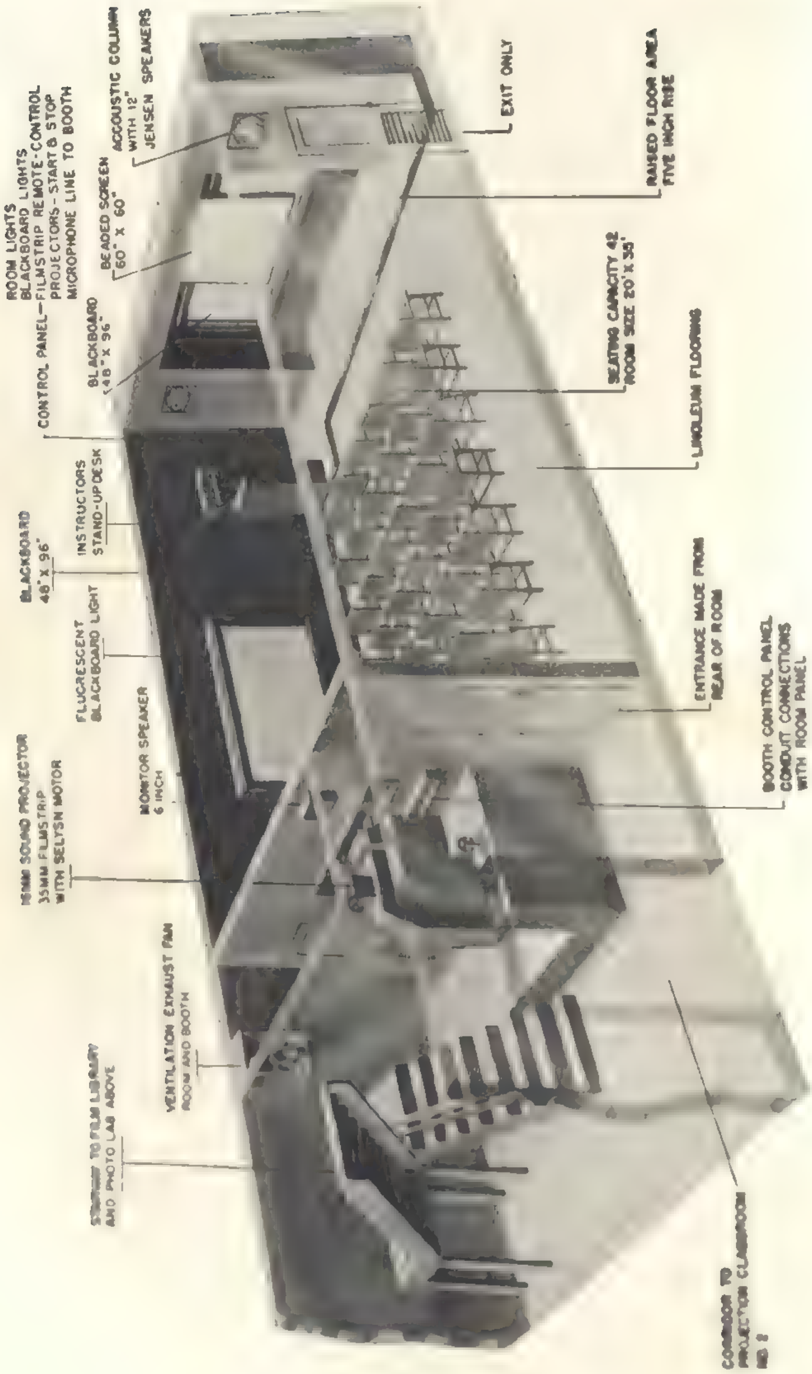
Gipson, Henry Clay, *Films in Business and Industry*, New York, McGraw-Hill Book Company, 1947.

Quigley, Martin, Jr., *Magic Shadows,* Washington, Georgetown University Press, 1948.

Magazine Articles

Griffith, John H., "Are You Guilty," *Educational Screen*, January 1948.

Dale, Edgar, "Seeing the Meaning," *Educational Screen,* January 1948.



Effective plan for film projection. (Courtesy of *Williamsport Technical Institute* and *Educational Screen*.)

CHAPTER X

Making a Projection Set-Up

The physical arrangement of the projection apparatus is most important for the successful use of projected teaching aids. It is not only advisable but necessary that the teacher be completely acquainted with the details of a satisfactory set-up. This knowledge will enable the teacher to be independent in providing a proper setting and in adjusting difficulties that may occur.

The teacher may wish to make a list of the suggestions and cautions given here and to use them as a guide in preparing a layout or in checking an existing set-up.

The Place of Projection

Where feasible, a room can be selected, set up and used especially for projection of motion pictures. This allows the equipment to be placed most effectively and to remain there permanently. Such an arrangement saves time in preparing for showings, keeps all material and equipment in one place, and is a great convenience. Whether projection is going to be done in a special room or in regular classrooms, the following suggestions apply:

Time of Preparation

Arrive prior to the students or audience so that the set-up may be made leisurely. Failure to heed this caution results in confusion, discipline problems, loss of time, annoyance, and general dissatisfaction.

Lighting Requirements

1. The location of the screen, the power of the projection lamp, the kind of pictures being projected and other factors govern the degree of darkness that must be had for satisfactory results. *Clear pictures, visible to everyone* should be the test for all arrangements.

In general, motion pictures require greater darkness than other types of projected aids, while high-powered slide projectors can give results that will be very satisfactory even in a fairly well-lighted room.

2. The light conditions of most rooms vary on account of the direction of exposure (east, west, etc.) and will therefore be different for various times of the day. Dark shades drawn over all windows will usually be sufficient for "darkening." If not, outside light can be further reduced through the use of draperies and heavy dark paper.

3. Flapping blinds and other causes of stray light such as Venetian blinds and light leakage through cracks set up competition with the projector. The larger the picture, the darker the room must be for clear projection. It is most desirable to obtain absolute darkness if possible. When showings are going to be made in almost complete darkness, keep a flashlight or a pilot light handy in case of emergency.

4. During the showing, prevent the opening of doors in the front of the room to avoid distracting sights, lights, and interruptions of casual intruders. It is a good practice to hang a sign on the outside of the door requesting no interference during the projection period.

5. Proper ventilation must not be neglected when the darkening provisions shut off the supply of air. In this case, baffle-type window ventilators or a blower should be used. Avoid opening windows that will blow the shades and admit too much light, especially near the screen. Forbid smoking while the projection is in progress.

Acoustical Controls

If possible, avoid a room where there is much noise outside. Rooms with uncovered hard floors (especially tile and stone), with many windows, with tile or brick walls, and with other poor acoustical characteristics may be unsatisfactory for use with sound reproductions. The qualities of sound films may be improved through the use of floor coverings, draperies, shades, and other forms of acoustical treatment. Most rooms, however, will give satisfactory results without any special precautions being taken.

It must be kept in mind when testing or using a room that the mere presence of an audience absorbs much of the sound and therefore the results will be different from those experienced while the room is empty. The acoustical conditions vary with different rooms

and, consequently, the operator must adjust the sound control to the point of greatest satisfaction.

Electrical Connections

The electrical aspects of the set-up are most important and therefore the following suggestions will prove of value.

1. The electric outlet supplying current to the projector should be on a separate circuit from the room lights so that these lights can be switched off without cutting out the projector.

2. Be sure that the kind of current available is suited to the projector to be used. Ascertain the voltage and whether or not the current is a.c. or d.c. If the wrong current is used, the results will be blown fuses or a damaged projector.

3. All connecting wires should be placed out of the way as much as possible. Run them along the wall so that students will not trip over them.

4. If wires pass a doorway, run them over the top and down again, not across the floor.

5. Avoid running wires across aisles.

6. Tie all connections together with cord to prevent their being accidentally separated during a showing.

7. Fasten the projector connection to the leg of the stand or table so that the projector will not be pulled to the floor if someone trips over the wire.

Location of Projector

The projector should be placed on a steady table or stand. If it is placed back of the students rather than in an aisle, it will be out of everyone's way and line of vision. If it is placed in the aisle, it may divert students' attention. However, the exact position of the projector is contingent upon other factors such as the size of the room, the number of students, the size of the screen, the focal length of the lens, and the power of the lamp. The brightness of the screen picture for any given lens varies inversely with the square of the distance between the projector and the screen.

The size of the picture can be changed by varying the distance of the projector from the screen and also by using lenses of various focal lengths. Longer focal length lenses project smaller pictures on the screen. For example, if a projector with a 3-inch lens throws

a picture that is too big for the screen, the picture can be made smaller by substituting a 4-, 5-, or 6-inch lens. If the screen and the projector are placed in their best positions, for the particular room, but the picture does not properly fit the screen, it is worth while to secure another size of lens to make the needed adjustment. The shorter focal length lens is desirable if the depth of the room is limited which in turn decreases the distance between the projector and the screen.

Projection Screens

Screens vary in size and type depending on the purpose for which they are to be used. The proper screen in each case is dependent upon several factors—the shape and size of the room, the distance of the projector from the screen, the light power of the projector, and the size of the audience. It is also necessary to decide whether or not the screen should be of the portable type or permanently installed. If the school has one or two screens to be used interchangeably in classrooms and in the auditorium, it is necessary to purchase the portable type. These types are shown below; they are appropriate for classrooms, homes, camps, conventions, and other places where pictures are shown at infrequent intervals.


Tripod Type


Wall Type


Table Type

The portables are convenient but require special attention to prevent their being knocked over by passing students and persons handling the program.

The wall and ceiling types are convenient and appropriate for use in training centers, auditoriums, community centers, meeting halls, etc. They are of two types.


Spring Roller


Rope and Pulley

SCREEN IMAGE TABLE FOR 16-MM PROJECTORS
(Dimension is width of picture)

Lens Focal Length	Distance From Screen										
	8′	10′	12′	15′	20′	25′	30′	35′	40′	45′	50′
¾″	4′ 0″	5′ 0″	6′ 0″	7′ 6″	10′ 0″	12′ 6″					
1″	3′ 0″	3′ 9″	4′ 6″	5′ 8″	7′ 6″	9′ 4″	11′ 4″	13′ 1″			
1½″	2′ 0″	2′ 6″	3′ 0″	3′ 9″	5′ 0″	6′ 3″	7′ 6″	8′ 9″	10′ 0″	11′ 2″	12′ 6″
2″	1′ 6″	1′ 10″	2′ 3″	2′ 10″	3′ 9″	4′ 8″	5′ 6″	6′ 6″	7′ 5″	8′ 5″	9′ 4″
2½″	1′ 2″	1′ 6″	1′ 9″	2′ 1″	3′ 0″	3′ 9″	4′ 6″	5′ 3″	6′ 0″	6′ 9″	7′ 6″
3″					2′ 6″	3′ 1″	3′ 9″	4′ 4″	5′ 0″	5′ 8″	6′ 3″
3½″					2′ 1″	2′ 8″	3′ 2″	3′ 9″	4′ 3″	4′ 10″	5′ 4″
4″					1′ 10″	2′ 4″	2′ 10″	3′ 3″	3′ 9″	4′ 3″	4′ 8″

This is a most satisfactory kind of screen when the installation is to be permanent, but it is not desirable to have the screen in view when not in use. In each case, the screen rolls up and disappears from sight. This not only keeps it clean, but also does not detract from the general appearance of the room when not in use.

This brief description will assist in the selection of a proper mounting. The other important factor is the screen surface because the picture is viewed as the result of reflected light. Naturally, the higher the reflective power of the screen surface, the more beauty and brilliance will be projected.

Screen surfaces are generally of two types:

a. *Matte white screen fabric.* This fabric may be combined with any one of the several mountings described above. It is less expensive and is very satisfactory for classroom projection. Because it does not have as high a surface brightness as a beaded screen, it is possible to seat the audience closer to the screen without any discomfort.

b. *The glass beaded screen fabric.* This type of screen is composed of thousands of brilliant glass beads firmly embedded upon a flat white surface. Because of this treatment, the screen reflects a greater portion of light than a screen with a matte surface. Although the picture is projected with greater brilliance, the viewing angle is smaller than that of the matte screen which diffuses the light farther to the sides.

Position of the Loud-speaker

To place the loud-speaker in the most advantageous position for satisfactory reproduction and reception of sound motion pictures, point it toward the center of the audience because high frequencies are highly directional. Rarely, if ever, should the speaker be placed on the floor.

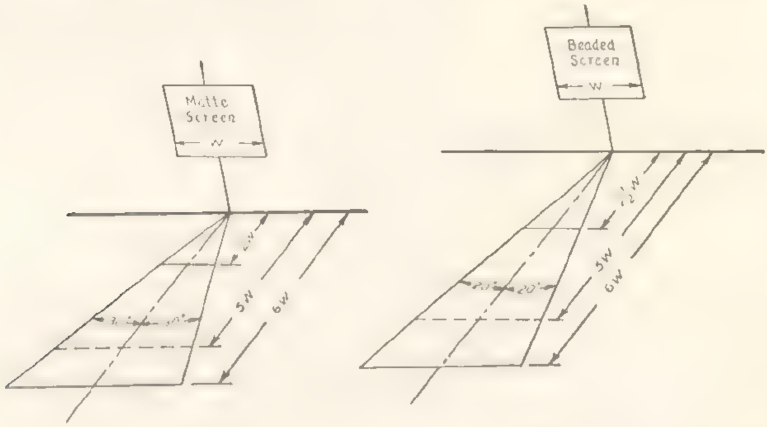
Since it is the high frequencies which determine the intelligibility of speech and the fidelity of music to a great extent, any positioning of the speaker which directs the reproduced sound over the heads of the audience or toward the floor or to one side of the auditorium will seriously impair reproduction.

In the ordinary classroom, the loud-speaker may be permanently installed over the blackboard on the front wall or in either front cor-

ner of the room. If not located permanently, provisions should be made to hang it in one of these positions, and in either case it should be pointed at the audience. An alternative to this suggestion is to place the speaker on a support about 4 feet high to the immediate right or left of the screen. The classroom does not present the acoustic problems of the auditorium and therefore less exacting conditions may prevail. The proper control of the volume is, no doubt, the most important feature for satisfactory instruction in the classroom.

Viewing Angle and Audience Location

If the spectator is not placed within the prescribed viewing angle and at correct distance from the screen, the picture will have a distorted appearance and lack brightness. It has been found that the most satisfactory viewing angle is 30 degrees on each side of a line



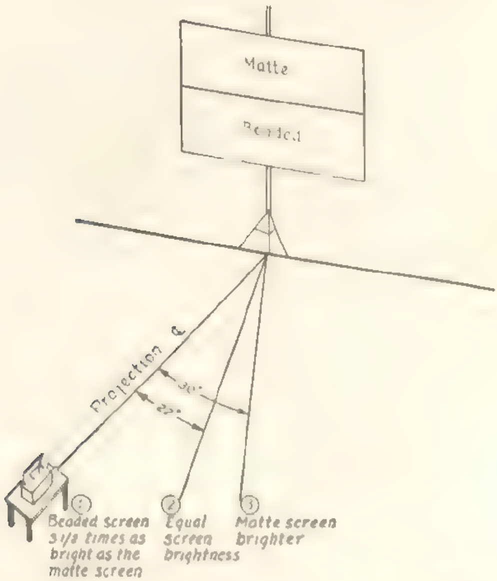
10-1 10-2

The proper viewing angle depends on the type of screen. A matte screen permits a wider viewing angle than does a beaded screen.

perpendicular to the center of the screen when a matte surface screen is used. This angle is reduced to approximately 20 degrees when a beaded screen is used (Figures 10-1 and 10-2).

In either case the viewing point of greatest advantage is on a line perpendicular to the center of the screen, which is designated as the projection axis. The brightness of the beaded screen at this point is much greater than the matte screen. A comparison of the two screens is shown in Figure 10-3.

The reflection characteristics of the surface also influence the minimum viewing distance from the screen. The Society of Moving Picture Engineers has developed recommendations concerning audience location. These suggested dimensions were developed in terms of picture width, designated as *W*. It was discovered by experiment that an individual with average eyesight cannot easily note all



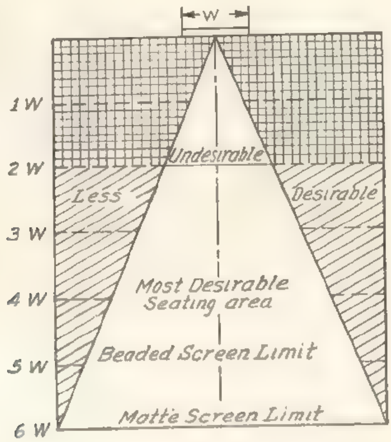
10-3. The viewing angle controls the apparent brightness of the beaded screen.

the details of a motion picture at a distance greater than six times (6*W*) the width of the screen. This relationship is reduced to 5*W* for slides and slide film because they are crowded and usually carry notes of explanation.

Also, there has been established a minimum viewing distance from the screen. To avoid eyestrain, it has been recommended that the first spectators' seats should be at least a distance of 2*W* from the screen when using a matte screen. If a beaded screen is used, the distance should be 2½*W* from the screen. These minimum standards have been set because of the eye fatigue produced by following the

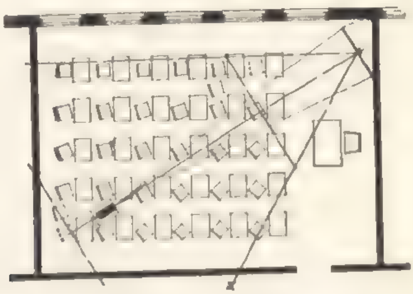
rapid-changing movements of a motion picture. The most desirable seating arrangement for maximum viewing comfort is shown in Figure 10-4.

This discussion naturally leads to the question, "What arrangement may be made in average classrooms for picture projection?"



10-4. Chart showing best seating arrangement for audience convenience.

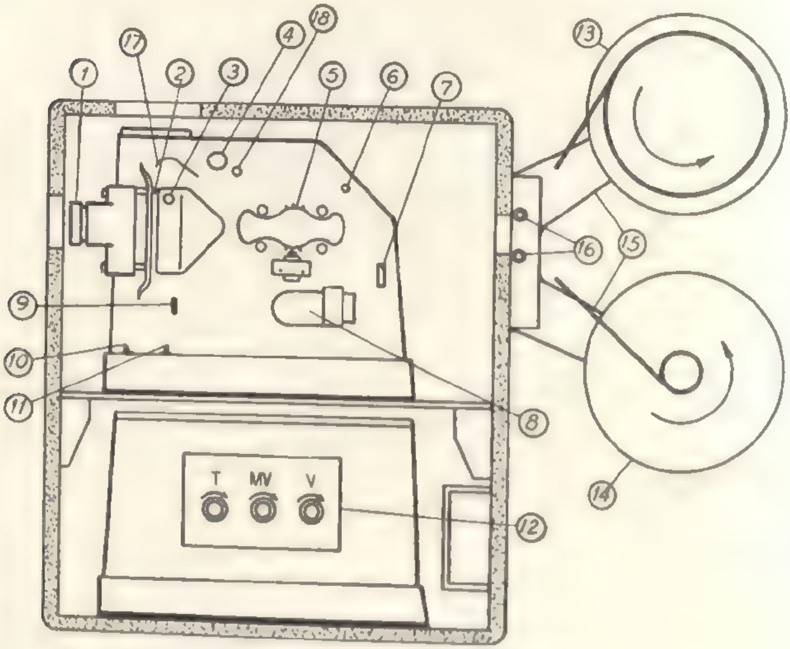
This question has been answered in the February, 1946 issue of the *Architectural Record* in an article by Adrian L. Ter Louw. The following modified excerpts and Figure 10-5 have been taken from this article:



10-5. Showing position of projector and seating in a classroom 22′ x 30′.

"This is the kind of room which is found in schools throughout the United States. It is 22 feet wide and 30 feet deep. Windows stop at a point about 4 feet in front of the chalkboard wall.

"Projection might be straight down the center of the room, or it



10-6. RCA Type 139 Projector-amplifier.

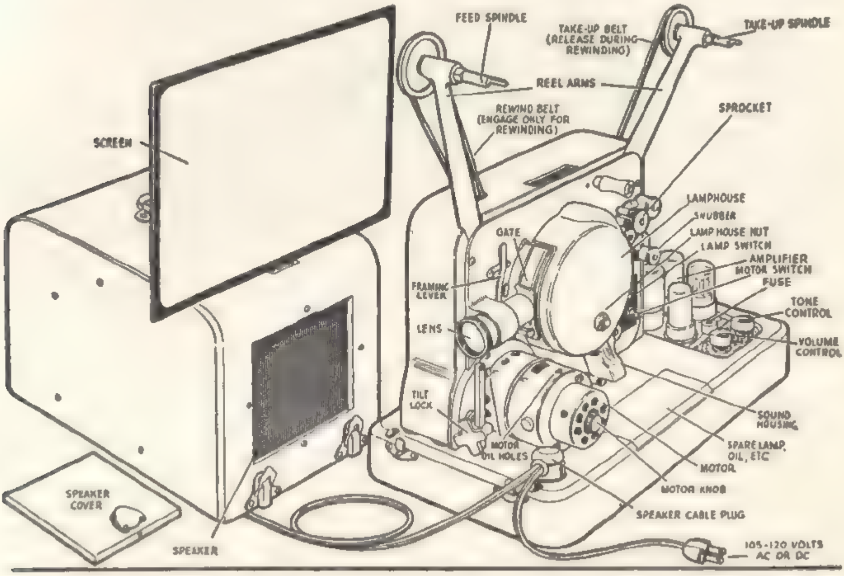
1 *Lens*
2 *Gate*
3 *Framing Knob*
4 *Pilot Light*
5 *Sprocket Drive*
6 *Film Advance*
7 *Speed Indicator*
8 *Exciter Lamp*
9 *Loop Setter*
10 *Pilot Light Switch*
11 *Projector Switch*
12 *Speaker Control Panel*
13 *Film Reel*
14 *Take-up Reel*
15 *Reel Support Arms*
16 *Film Guide Rollers*
17 *Raised Loop Indicator Line*
18 *Speed Adjustment*

might be pointed diagonally toward either front corner. The latter has been chosen because there is a minimum distance to move the stand and projector. Sight lines are unusually favorable because no seat is in the direct line of view of the seat behind it. Only two students have to be moved before projection begins.

"For convenience and easy maintenance, the screen is perma-

nently mounted on a high hinged panel, which is swung out into position when projection is ready to begin.

"The squares in the diagram represent seats in position for projection. The student in the front left corner has been moved back to a position behind the permissible front seating line, and the rear corner student has been moved away from behind the projector."



10-7. Schematic diagram of the Movie-mite sound projector.

If the problem arises to plan a projection set-up for a classroom of different shape, it is very easy to make the layout by the use of a plan view drawn to ¼-inch scale. This drawing, made to scale, representing the students seats, other furniture and the projection apparatus, will simplify the job. The constant factors to remember are:

1. 60° included maximum viewing angle.
2. *W* equals width of picture.
3. The front seats should not be less than 2*W* from screen and the rear seats 6*W* from the screen.

It is a good practice to arrange the audience in front or on both sides of the projector and be sure that the seats are arranged orderly.

TROUBLE CHART
for
MOTION PICTURE
PROJECTOR

This chart identifies with a X the probable causes which should be investigated for the more common trouble symptoms listed.

When the projectionist is not qualified to make the necessary adjustments, the nearest service agency of the manufacturer should be consulted.

PROBABLE CAUSE OF TROUBLE

TROUBLE SYMPTOMS	Low line voltage	High line voltage	Speaker improperly or not connected	Amplifier not on	Amplifier tube defective	Exciter lamp defective	Photo electric cell defective	Projector lamp burned out	Projector lamp out of alignment	Lens incorrectly focused	Film incorrectly threaded	Volume control not on or defective	Fuse burned out	Projector cable broken or loose	Defective motor belts	Poor acoustics	Dirty projection lens and reflectors	Speed control at wrong position	Film channel dirty	Lack of or too much oil	Motor governor brushes dirty or damaged	Gate pressure shoe not seating properly	Poor contact in line cord	Poor screen or extraneous light	Defective or dirty film	Improper polarity or plugs switched	Faulty switch	Dirty sound lens	Motor commutator dirty
NO SOUND			X	X	X	X	X				X	X	X	X					X				X			X	X	X	
IMPAIRED SOUND	X		X		X	X	X				X	X		X	X	X		X	X	X	X	X	X		X	X		X	X
NO PICUTRE PROJECTED								X															X				X		
POOR PICTURE PROJECTED	X								X	X	X				X		X	X	X			X	X	X	X				
HUM OR OTHER NOISE	X	X	X		X	X	X				X	X		X						X	X					X		X	X
IRREGULAR MOTOR	X	X												X						X	X		X						X
SOUND NOT SYNCHRONIZED											X																		
LOSS OF FILM LOOPS											X											X			X				

10-8. Adapted from Projectionist's Handbook.

References

1. Research Council. Academy of Motion Picture Arts and Sciences. Motion picture sound engineering; a series of lectures presented to the classes enrolled in the courses in sound engineering given by the Research Council of the Academy of Motion Picture Arts and Sciences, Hollywood, California. New York, D. Van Nostrand Co., Inc., 1938. 547 pp.

CHAPTER XI

The Use of Motion Pictures

The motion picture is of value to the extent that it contributes to more effective teaching and greater student comprehension. This same statement may be made of all teaching aids. If such is the case, every teacher must challenge himself with the question, "Will my teaching be more efficient and will the students learn more rapidly and with greater understanding if I use films?" The teacher will be more discriminating in his choice of films if he uses such a criterion. He will at least avoid the use of films as a respite from an otherwise dull presentation of a subject.

The motion picture film takes precedence over other forms of teaching aids when motion is necessary to the understanding of the subject matter. The variety and interest provided by the motion picture, in addition to close-ups, slow-motion, and animation, stimulate learning and understanding not possible through other visual media. In addition, the effect of the sound with motion pictures further stimulates learning, particularly in those cases where the sound is necessary for developing the correct impressions about the subject being presented.

The possible number of situations in which motion pictures may be used is too large to permit an enumeration of suggestions of what is required in each circumstance. We shall, therefore, direct our suggestions to the teacher who is interested in the educational advantages of projected pictures, who has little or no experience in using them; who will take entire charge of his own equipment, who will correlate his own material and who will have to use the equipment in the best way he can under conditions as he finds them or can reasonably make them. We shall also assume that the teacher will use motion pictures, that he has fairly modern equipment, and has or can secure a good amount of picture material. Many of the suggestions will have broader application than is indicated, but we shall leave it

for the teacher to decide what he can apply to his own particular curriculum needs.

The film producers may supply animated drawings, use trick photography, supply attractive color, add running comment, retard accelerated motion, and utilize good showmanship, but their efforts must be supplemented by carefully planned procedures on the part of the teachers if the films are to be used successfully for instructional purposes. It is the purpose of this chapter to explain techniques of using motion pictures which will result in bigger educational returns to the student.

Why Use Motion Pictures?

Motion pictures can be helpful in one or more ways in practically every kind of course. They are widely used:

1. To introduce a subject by showing background or history, sources of supply, processes to which materials are subjected, etc.
2. To arouse, sustain, or heighten interest by taking advantage of the dramatic appeal which is natural to this medium.
3. To develop interest in manipulative skills and judgment ability.
4. To sum up a lesson on a subject or to clarify or emphasize it.
5. To demonstrate motion or the action of moving parts in connection with other means of teaching these things. For example, use a motion picture to visualize the internal workings of an automobile engine after teaching the relationships and movements of the engine's parts through shop work, texts, and still pictures.
6. To develop certain desirable attitudes to work, civic affairs, national trends, and co-workers. These things can be effectively dramatized by motion pictures.

Selection of Films

The following suggestions are worthy of the teacher's consideration in the selection of films for instructional purposes.

Use films that:

1. Show simple, direct treatment.
2. Challenge the students' thinking.

3. Depict basic principles and operations.
4. Present clearly the technical facts or information.
5. Alternate a series of "shorts" with discussion.
6. Dramatize and recreate events.

Hesitate to use films that:

1. Are "interesting" but present little or no useful information for student learning.
2. Are technically correct but have no specific application to the problems of your training schedule or course of study.
3. Are of considerable length with a limited amount of useful consideration.
4. May be considered as "dessert" or entertainment as far as the course of study is concerned.
5. Consume the entire period and permit no time for discussion.

The above suggestions pertain to classroom instruction wherein the objective is the presentation of specific subject matter included in a course of instruction. They would not necessarily apply to assembly programs. It is the duty of the individual instructor to select the films that will aid best in the teaching of the unit for which the selection is being made. Thus, a teacher of the carpentry trade should select films that will assist in developing skills and in understanding jobs within the scope of the trade, such as seasoning lumber, rough framing, laying floor, making concrete forms, stair building roof framing, constructing interior trim, and many others. The instructor may also choose a film showing the cutting of lumber and its subsequent treatment including kiln drying and final use by the consumer. In each of these cases, the films are appropriate, interesting, specific, and of immediate value to the young craftsman.

Films for Instructional Purposes

There is a very large number of films available in every conceivable subject, but they vary in quality and completeness. Although there were many films available before World War II, the number has been definitely multiplied through the efforts of the U. S. Department of Education, the military authorities, and forward-looking industrialists. Consequently, there are available today thousands of films which are distributed through film libraries, universities, indus-

trial concerns and film producers. A number of comprehensive lists have been compiled which classify the films according to subjects. A list of sources will be found at the end of this chapter. The annotations in each of the lists consist of a very brief synopsis, the number of reels, size, running time, silent or sound, black-and-white or colored, source, and whether secured free, by rental, or by purchase.

Note: See the special list of films at the end of this chapter that shows and explains how to use films for instructional purposes.

Sources and Choice of Proper Films

The teacher interested in the use of films

1. *Should search for film sources*
   a. Within the school system
   b. From public film libraries
   c. By loan from: public institutions, educational organizations, and manufacturers and business concerns
   d. Through rental from film libraries and producers
   e. By purchase from producers or dealers
   Note: Two good sources of current productions are: The H. W. Wilson monthly list of most recent productions, and the announcements in Educational Screen, Business Screen, and See and Hear.
2. *Should determine needs.* The teacher should estimate his pictorial needs for his particular subject. The best films are those that were developed in progressive steps and in a sequence adapted to the course of study. Several short films are to be preferred to long films, as they can be used with small units of instruction. A common criticism of a majority of films is "they include too much."
3. *Should evaluate the available films*
   a. It is advisable to read the descriptions of individual films given in the catalogs and descriptive literature to formulate some idea of the content of the film. It is furthermore wise to solicit the experiences and recommendations of users and producers of films when forming tentative decisions as to which would best fit a particular program.
   b. Whenever possible, preview the films for direct appraisal prior to a student showing. Immediately after the preview

the instructor should evaluate the film and record his opinions on a form similar to the one shown elsewhere. Provision should be made for a permanent file of this information for future reference.

c. This proposed evaluation of rating has a dual purpose:
    1. It assists the teacher in the effective use of the film by directing attention to its omissions and commissions. This in turn enables the teacher to provide supplementary instructional material.
    2. It is a permanent record of the film and therefore serves as a guide for its future use.

d. The following factors are pertinent in such an evaluation:
    1. *Learning level*—Is the language simple enough for the immature learner to understand easily or is it technical to suit the advanced student?
    2. *Presentation*—Is the presentation orderly and in a logical sequence? Does it progress in easy steps that are readily understood or is the sequence confusing?
    3. *Timeliness*—Is the material in line with present practice or is it obsolete or in advance of existing conditions?
    4. *Type*—Does it provide merely entertainment or does it offer desirable general information? Does it give specific instruction on a topic or the performance of a series of definite skills?
    5. *Accuracy*—Does it present correct information and authentic data or is the information or skills presented questionable as to its accuracy?
    6. *Clarity*—Are the facts and skills thoroughly presented or are details omitted that prevent complete understanding?

4. *Should correlate films with the course of study.* The problem at this point is the selection of films which will fit the subject matter needs of a particular course. A good film will be on the proper mental level of the students and will not cover more points than students can absorb at one showing. Expository or demonstration films should not exceed a total showing time of over 40 minutes approximately. In a majority of cases, films of 10 to 20 minutes duration are most satisfactory for instructional purposes.
5. *Should select films for specific purposes.* After choosing a num-

ber of films to be used in a course such as science, mathematics, or industrial information, the next step is to decide which of the following objectives it will meet:

a. To explain, clarify, show how or why.
b. To supplement the teacher's oral explanation or that of a textbook.
c. To serve as an introduction, review, summary or preparation for succeeding lesson.
d. To assist in the acquisition of a skill.

6. *Should co-ordinate aids.* Motion picture film should not be used without other teaching aids which may be co-ordinated with it, such as models, charts, and slide films. Despite the use of a good motion picture, it still may be necessary to supplement it with other visual material to insure complete understanding of the subject.

The Preview

The preview of the picture by the instructor is one of the most important factors in film selection, a factor so important (but frequently neglected) that it merits additional comment at this time. The film should be requested for a date sufficiently in advance of the showing to allow the teacher adequate time to become acquainted with its content. A film is not unlike other teaching tools and requires considerable familiarity with it to insure its effective use. It is during this preview period that a teacher may formulate challenging questions around which he hopes to have the discussion revolve.

In general, the failure to preview educational films is the outstanding weakness in their use. This is a most essential part of the teacher's preparation and without it the value of the film is greatly reduced. Despite any synopsis given by the distributor, the preview is necessary for effective results. This preview period also may avoid wasting the time of students with a film that cannot be defended pedagogically.

The preview should serve as an informal rehearsal of the actual showing, with special attention given to the length of time required for the presentation. The running time should be recorded on the suggested form because this factor is an important element in fitting a film into the school program. This procedure will uncover difficulties not anticipated, as well as perfect the technique of using film

within an allotted period of time. It will not only determine definitely whether or not the films are relevant to the topic of the lesson and in accordance with the objectives of the course, but also serve as a guide in the detailed preparation of the lesson. In many cases, training guides are provided with the film. These guides indicate the main points to be observed and suggest questions for follow-up.

The following suggestions are made in connection with the teacher's preparation during the preview:

1. Note the specific points of special interest and the frames where they occur.
2. Decide on the necessary or desirable supplementary information to be used.
3. Decide how to correlate the film with your pre-arranged course of study.
4. Indicate how the film may be connected with the students' previous experience.
5. Select the specific applications to be made within the students' experience.
6. Determine how many times the film should be shown and the purpose of each showing—for appreciation, information, viewpoint or entertainment—again for study—once more for review or summary.
7. Decide the procedure of presentation—with or without the sound track—teacher reading the captions—or students—or both.
8. Choose the best time to show the film—before or after an explanation or demonstration—or before and also after.
9. Formulate questions and assignments to be used as a follow-up of the showing.

The above suggestions, if followed, will enable the teacher to make ample preparation for a successful showing. It is probable that some modifications of these preparations will be necessary when the class assembles. The Encyclopaedia Britannica has available a film "Using the Classroom Film" that presents the techniques of using a motion picture. This film has considerable merit, and it is to be recommended for teacher training purposes. It depicts a teacher previewing a film and deciding on the majority of points (1-9) indi-

cated above. The teacher's preview is followed by a meeting of the class, at which time the teacher discusses the film to:

1. Introduce the film in a way that will place the students in a receptive mood.
2. Arouse anticipation.
3. Point out the purpose of the showing.
4. Connect the new information to be presented with the past experience of the students.

One effective way of introducing the film is to list on the blackboard questions on the subject that will be answered by the film. These questions may be those formulated by the teacher during the preview and supplemented by questions posed by the students during the introductory discussion. It is advisable to inform the class that a test will follow the presentation, and consequently an effort will be made by the students to discover the answers to the questions by giving close attention to the showing. The teacher should explain briefly the type of film to be shown and its relationship to the work already completed or studied in the course.

The use of an Instruction Guide shown in Figure 11-1 serves as a very effective way to prepare a student for viewing a motion picture. It has the distinct value of being a permanent record for the student to file in his notebook. In addition, it may be attached to the reference reading assignment when submitted to the teacher for review and correction. The teacher in turn can record his rating of the assignment at the place designated before the material is returned to the student.

After the class is placed in a completely receptive frame of mind, the film should be presented. When a desire to see the film has been developed, it is the most favorable psychological time for the showing.

Check Equipment

It is necessary for the teacher to make certain physical preparations and check on the equipment before the class convenes. The following list will be suggestive of the things to be done.

1. Check the equipment for perfect operation.
2. Assemble supplementary materials noted on the preview notes recorded while previewing the film. Be sure to have at hand the required films, slides, records, charts, exhibits, displays, and demonstration apparatus.
3. Make the set-up. When the equipment must be set up before each showing and then removed, refer to the suggestions given under "Making a Projection Set-Up" page 221. Make a list of the things that must be done and then refer to it as a guide. Mark the floor in order to place the projector quickly. Some projector stands are equipped with wheels to facilitate shifting to the proper position.
4. Insert the film in the projector and adjust for correct focus. Have it on the first frame ready to start. When sound equipment is used, "turn on" the amplifier so that the tubes may "warm up" and be ready to function. Adjust the volume after the starting of the picture. Be sure the loops are large enough when threading the film to prevent breakage and other damage. It is good practice to check the threading with the manufacturer's diagram. *Prepare everything that can be done in advance* so that the projection will start smoothly with the turn of a switch. It must be remembered that a sound film cannot be projected on a silent machine.
5. Make advance arrangements for any assistance that will be required or that will contribute to smoother operation. Appoint a student to turn the room lights on and off upon previously arranged signals; someone to darken the windows, etc. If an assistant is going to operate a slide projector while the teacher stands near the screen, arrange some signals for changing the pictures that will not be distracting to the students. A small, pocket flashlight will serve the purpose. Especially for large classes, a "cue light" can be used with the teacher pressing a hand or foot button to flash a signal on a small shaded light near the operator. This system is especially effective where rear projection is employed. When working in this manner, the teacher will find a pointer convenient in directing attention to details of a picture.
6. Read the instructional guide provided by the producer to absorb all special suggestions for using the film.

NATIONAL VOCATIONAL SCHOOL
Teaching Aids Department

INSTRUCTION GUIDE
for viewing the training film
The Cutting of a Spur Gear

Reason for showing this film

The cutting of a gear is a very exacting operation and consequently the figuring of the parts requires accuracy. This film depicts clearly and completely the operations performed and the related mathematics involved and its application.

Points to observe and remember

1. The parts of a spur gear.
2. The mounting of the gear blank.
3. The selection of the cutter.
4. The ratio of the dividing head.
5. The setting of the cutter in relation to the blank.
6. How the correct depth of tooth is obtained.
7. The setting of the dividing head.
8. The gashing of the teeth.
9. The setting of the speed and feed mechanism.
10. The final cutting operation.

Vocabulary necessary to understand this film

1. pitch
2. addendum
3. dedendum
4. diametral pitch
5. index plate
6. index crank
7. pitch line
8. pitch circle
9. vernier gear caliper
10. root diameter
11. gear ratio
12. indexing
13. gashing
14. worm
15. worm wheel

Reference reading for thorough understanding of subject

Machinery Handbook—Pg. 549
Burchardt—Machine Tool Operation Pp. 244-252

Student Name____________________ Rating____________

During Presentation

If a sound film is being used, the teacher is compelled to stand by until the showing is completed. In this case, all necessary comment comes from the sound track and usually is satisfactory because professional talent is used.

The silent film may be, and probably should be, supplemented by the instructor's comments and explanations. A pointer may be advantageously used to direct the attention of the students to specific features of the picture. Although the average student may be reasonably observing, he may overlook very important factors, and therefore the teacher should direct the observation if best results are to be secured.

Additional Showing

It is possible that in a majority of cases one showing of a picture will be found satisfactory. There are other situations, particularly in the use of vocational and technical films, when more than one showing is required. The additional "run" may result from the discussion following the first showing when it is discovered that some important points were overlooked and misconceptions formed. The second or third showings may be given on succeeding days, preceded by study and discussion. During these repeat showings, the teacher may find it advisable to explain the points in question. In the case of a sound film, the teacher may choose to "shut off" the sound and substitute his own comments.

Follow-up

There is no more important phase of using motion pictures for instructional purposes than the immediate follow-up of the viewing. It is at this point that the teacher must discover whether or not the students gained in knowledge and understanding. It is the time to answer student questions as well as challenge the students with queries about the picture. There should be free discussion on the subject with the objective of removing any false impressions that may exist and of clarifying any doubtful facts. It will be a real test of the students' power to observe and their ability to do reflective thinking.

It is sometimes a good practice to follow the discussion period by

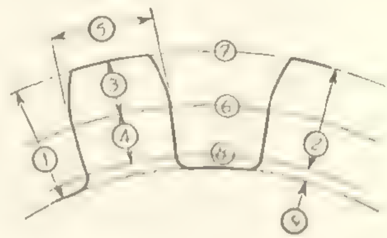
NATIONAL VOCATIONAL SCHOOL
Teaching Aids Department

FILM TEST
The Cutting of a Spur Gear

Name____________ Class____________ Date__________

Instructions: Place in the blank spaces beside the names of the gear parts, the numbers that indicate the respective parts in the drawing.

a.______ *Clearance*
b.______ *Working depth*
c.______ *Whole depth*
d.______ *Addendum*
e.______ *Dedendum*
f.______ *Width of tooth*
g.______ *Pitch circle*
h.______ *Outside circle*
i.______ *Base circle*



Questions:

a. What is the gear ratio in the dividing head? ______ to ______.
b. What is the diametral pitch? ____________

c. What is meant by gashing? ____________

d. Where is the thickness of a gear tool measured? ____________

e. What is the common system of gearing called? ____________

Rated by____________ Rating______

11-2

a brief test. Suggestive tests for follow-up purposes are shown in Figure 11-2. If time is not available, it may be administered the next day. If the students are advised of the test, it will place upon them the responsibility for close attention. Despite any test that may be given a specific assignment is essential if the skill or information is to be retained. This procedure is particularly impor-

tant in vocational and technical work. In many cases, the information presented and the skills demonstrated are essential to the solution of certain problems or the completion of definite jobs within the students' training course. It logically follows that some specific application of the knowledge gained from the pictures should be made immediately. The assignments are dependent on the subject matter and the facilities available. The assignment may be in the form of work to be done, investigations to be made, a visit to an industrial plant, a demonstration of skill, a written test, references to be read, or a report to be submitted. Examples of assignments are indicated in the succeeding pages when the use of special films is discussed.

Queens Vocational High School Student.............. Score......
Class........ Date..........

THE MACHINE SHOP TEST

Directions: To show correct answer draw circle around it, underline it, or fill in blank space with missing word or words.

TITLE OF FILM ....

1. One of the most commonly used gears is called a .... gear.
2. Gears can be cut on a Milling Machine. T F
3. Gears are used to transmit ....
4. The imaginary line for measuring all teeth dimensions is called (Addendum) (Dedendum) (Pitch Line) (Diametral Pitch).
5. The ratio of the number of teeth per inch to Pitch Diameter is called (Dedendum) (Circular Pitch) (Clearance) (Diametral Pitch).
6. Give Diametral Pitch of gear having 20 teeth on 5 inches Pitch Diameter. ....
7. The specifications of every gear tooth cutter is marked on cutter. T F
8. The two parts of Dividing Head Centers are called (a) ...., and (b) ....
9. One turn of the Dividing Head Crank rotates work .... of a turn.
10. In formula $\frac{40}{N} = T$, N stands for .... and T stands for ....

11. The Indexing Plates have circles of holes numbered to indicate (teeth to be cut) (holes in circle) (crank turns per revolution).
12. The depth of cut is calculated from the position at which the cutter just scrapes gear blank. T F
13. The Tailstock may be adjusted to various heights and ....
14. The adjustable arms on Index Plate are called .... Arms.
15. To get a smooth finish, increase the speed and .... the feed.
16. The large end of the Mandrel should be nearest the Tailstock. T F
17. The thickness of the gear tooth is measured with a ....
18. How much metal is removed per revolution if the cutter has 20 teeth and the chip thickness is 0.003 inch? ....
19. Give number of turns of crank to cut 25 teeth. ....
20. Which has the greater measurement, (a) Addendum (b) Dedendum?

Queens Vocational High School — Student.............. Score...... Class........ Date..........

THE MACHINE SHOP TEST

Directions: To show correct answer, draw a line under it, draw a circle around it, or fill in the blank space with missing word or words.

TITLE OF FILM ....

1. A good machinist must understand the machining properties of metals. T F
2. The word "Aluminum" is only used to describe the pure metal. T F
3. Aluminum is (easy) (difficult) to machine.
4. Aluminum cannot be heat treated. T F
5. Aluminum is alloyed with copper, zinc, and magnesium. T F
6. Numbers and .... are used as type symbols for aluminum.
7. When chipping aluminum, lubricate chisel with (heavy oil) (light oil) (lard oil) (kerosene).

8. Aluminum can be removed rapidly with a curved-tooth file. T F
9. A long angle file is used for .... filing aluminum.
10. To ream a hole ⅝ of an inch in diameter, use a 0.640-inch diameter drill. T F
11. Straight and .... fluted taps can be used on aluminum.
12. Tool bits for cutting aluminum require which of the following (two): (more top rake) (less top rake) (more side rake) (less side rake).
13. Carbon steel tools are used for mass production of large work. T F
14. Cemented carbide tools are superior to high-speed steel tools. T F
15. Finishing tools require (large rake angle) (small rake angle).
16. Tool bits should be .... to give keen cutting edge.
17. Parting tools require ...... to ...... degrees top rake.
18. Aluminum expands (more) (less) than steel when heated.
19. Aluminum may warp or bend when overheated. T F
20. Cutting compounds result in a (smoother) (rougher) finish.
21. One type of cutting compound consists of 50% of (two): (machine oil) (kerosene) (lard oil) (liquid soap).
22. .... tailstock centers improve results of high speed turning.
23. When planing aluminum tool should be .... on the return stroke.
24. Aluminum may be milled at (high) (low) speeds.
25. A 59-degree drill point is correct for drilling aluminum. T F

References

Films and Slides about the Use of Visual Aids

1. "Bring the World to the Classroom," 16 sd., #303, Encyclopaedia Britannica Films, 20 N. Wacker Drive, Chicago 6, Ill. Selected sequences from Encyclopaedia Britannica Classroom films illustrate how the variety of techniques used in classroom films (such as close-up, animation, slow motion, time lapse, micrography, etc.) facilitate learning. By overcoming limitations of time and space, by presenting reality operating functionally; by bridging the chasm of verbalism and abstractions.

2. "Film Tactics," 22 min., 16 sd., 1947 (U. S. Navy Castle Film used by the Training Aids section of the Navy). Shows the right and wrong methods for classroom use of audio-visual aids. Castle Films, 30 Rockefeller Center, New York, N. Y.
3. "Hand-made Lantern Slides, 10 min., 16 si., 1937. Produced by Dr. G. W. Lehman, Inst. in Vis. Ed., N. J. State Teachers College. Clear treatment of techniques for slide-making. International Theatrical and Television Corp., 25 W. 45th Street, New York 19, N. Y.
4. "How to Teach with Films," 16 min., 16 sd., 1946. How to prepare for and use a teaching film. An actual demonstration is made from start to finish. Cathedral Films, Inc., P.O. Box 589, Hollywood, California.
5. "Tips on Slidefilms" (92 frames). Jam Handy Organization, 2900 E. Grand Blvd., Detroit 11, Michigan.

   An individual discussional slidefilm to help teachers realize the greatest benefit from the use of slidefilm visual aids. Shows various types of projectors and their care, how to arrange the room and necessary preparation.
6. "Using the Classroom Film," 2 reels, 22 min., 16 sd., 1945. Demonstrates an approved method for teaching with classroom films in one specific learning situation. Presents the responsibilities of the teacher in preparing for a film lesson. Encyclopaedia Britannica Films, 20 N. Wacker Dr., Chicago 6, Ill.
7. "Using Visual Aids in Training," 14 min., 16 sd., Association Films, 347 Madison Avenue, New York 17, N. Y.

Books

1. Brunstetter, M. R., *How to Use the Educational Sound Film*, Chicago, The University of Chicago Press, 1937.
2. Dale, Edgar, *Audio Visual Methods in Teaching*, New York, Dryden Press, 1947.
3. Dent, Ellsworth C., *The Audio-Visual Handbook*, Chicago, Society for Visual Education, Inc., 1946. 226 p.
4. Devereau, F. L., *The Educational Talking Picture*, Chicago, The University of Chicago Press, 1935.
5. Fern, George H. and Robbins, Eldon, *Teaching With Films*, Milwaukee, The Bruce Publishing Company, 1946. 146 p.
6. Heiss, E. C., Obourn, E. S. and Hoffman, C. W., *Modern Methods and Materials for Teaching Science*, New York, Macmillan Co., 1940.
7. Hoban, C. F., *Focus on Learning*, Motion Pictures in the School, for Committee on Motion Picture in Education, Washington, D. C., American Council on Education, 1942.
8. Hoban, C. F., *Visualizing the Curriculum*, New York, The Dryden Press, 1937.

9. Hoban, C. F., *Movies That Teach*, New York, Dryden Press, 1947.
10. Hollis, Andrew Phillip, *Motion Pictures for Instruction*, New York, The Century Company, 1926. 450 p.
11. McDonald, G. D., *Educational Motion Pictures and Libraries*, Chicago, American Library Assn., 1942.
12. McKown, Harry Charles and Roberts, A. B., *Audio-Visual Aids to Instruction*, New York, McGraw-Hill Book Company, Inc., 1940. 385 p.
13. Rulon, P. J., *Sound Motion Pictures in Science Instruction*, Cambridge, Harvard University Press, 1933.

Sources of Film Guides

1. Almanac of Films for Special Occasions with Suggested Themes for Programs. 75 p. 50¢. Division of Visual Experiment, Harmon Foundation, 140 Nassau Street, New York City.
2. Bibliography of Aviation Education Materials. Macmillan Co., 1942.
3. Bibliography of Motion Pictures for Vocational and Technical Schools, 329 p. 1942, New York, 227 E. 9th Street, Gilbert G. Weaver.
4. Catalog, Castle Film, 30 Rockefeller Plaza, New York City.
5. Catalog, Jam Handy Corporation, 2900 E. Grand Boulevard, Detroit, Michigan.
6. Catalog of Films for Church and Community Use. 88 p. 35¢. The Religious Film Association, 45 Astor Place, New York City.

   A selective listing of over 200 16-mm films, silent and sound, film strips and kodachrome slides.
7. Catalog of Films for Classroom Use. Teaching Film Custodians, Inc., 25 W. 43rd Street, New York, N. Y.
8. Catalog of International Film Bureau, 84 East Randolph Street, Chicago 1, Illinois.
9. Catalog of 16-mm Educational Film Producers. Encyclopaedia Britannica Films, Inc.
10. Directory of Films on Cripped Children and Related Subjects. 6 p. Free. 1943. National Society for Crippled Children, Elyria, Ohio.

    Motion pictures that are available for loan and films that are shown only by representative of owner are listed by states and cities within each state.
11. Directory of 16-mm Film Sources—DeVry Corporation, Armitage Avenue, Chicago, Illinois.
12. Directory of 16-mm Sound and Silent Motion Picture Films and 2″ x 2″ and Standard Slides. $1. 1943. Visual Education Division, Illinois Institute of Technology, 3300 Federal Street, Chicago, Illinois.
13. Directory of Training Films: Educational Films on Merchandise,

HOW TO OBTAIN U. S. GOVERNMENT FILMS[1]

(Compiled by Seerley Reid)

U. S. Government Agency	Kind of Films	How to Borrow or Rent Films[2]	How to Purchase Films	For Further Information
Department of Agriculture (including the U. S. Forest Service and the Soil Conservation Service)	172 information and training films on agriculture and forestry	Borrow from State Extension Services, Regional Offices of the U. S. Forest Service and Soil Conservation Service and other official USDA film depositories. Rent from some educational film libraries.	From Castle Films, Division of United World Films, Inc., 445 Park Ave., New York 22, N. Y.	Motion Picture Service, Office of Information, U. S. Department of Agriculture, Washington 25, D. C.
Department of the Air Force	22 information and public relations films; 24 training films	Borrow public relations films from Air Material Area Headquarters of the Air Force. Rent training films from some educational film libraries.	Purchase training films and 11 of the public relations films from Castle Films. Other films not for sale.	Directorate of Public Relations, Department of the Air Force, Washington 25, D. C.
Civil Aeronautics Administration (Department of Commerce)	10[illegible] Navy films on aeronautics and related subjects for aviation education	Borrow from Regional Offices of the CAA.	Not for sale.	Aviation Education Division, Civil Aeronautics Administration, U. S. Department of Commerce, Washington 25, D. C.
Coast Guard (Treasury Department)	16 information films on Coast Guard activities	Borrow from Coast Guard Headquarters, Washington 25, D. C. or from District Headquarters.	Not for sale.	U. S. Coast Guard, Treasury Department, Washington 25, D. C.
Office of Education (Federal Security Agency)[3]	457 vocational and industrial training films	Not for loan. Rent from some educational film libraries.	From Castle Films.	Visual Aids Section, U. S. Office of Education, Federal Security Agency, Washington 25, D. C.
Fish and Wildlife Service (Department of the Interior)	12 educational and training films on fishery.	Borrow from Fish and Wildlife Service, Washington 25, D. C. or from Regional Offices.	Purchase 4 films from Castle Films; other films from original producer.	Branch of Commercial Fisheries, Fish and Wildlife Service, U. S. Department of the Interior, Washington 25, D. C.
Forest Service (Department of Agriculture)	27 information and training films on forestry and fire prevention	Borrow from Regional Offices of the Forest Service. Rent from some educational film libraries.	From Castle Films.	Forest Service, U. S. Department of Agriculture, Washington 25, D. C.
Indian Service (Department of the Interior)	9 information and educational films on Indian life	Borrow from Visual Aids Service, Haskell Institute, Lawrence, Kan.	From Educational Film Laboratory, U. S. Indian School, Sante Fe, New Mexico.	Bureau of Indian Affairs, U. S. Department of the Interior, Washington 25, D. C.
Institute of Inter-American Affairs	1[illegible] information films on health and agricultural subjects	Not for loan.	From Institute of Inter-American Affairs.	Institute of Inter-American Affairs, 499 Pennsylvania Avenue, Washington 25, D. C.

U. S. Government Agency	Kind of Films	How to Borrow or Rent Films[2]	How to Purchase Films	For Further Information
Marine Corps (Navy Department)	16 public information and recruiting films.	Borrow from Marine Corps District Headquarters Recruiting Stations.	Not for sale.	Director of Public Information, U. S. Marine Corps, Navy Department, Washington 25, D. C.
Bureau of Mines (Department of the Interior)	80 information films on mining and metallurgical industries.	Borrow from Bureau of Mines Experiment Station, 4800 Forbes St., Pittsburgh 13, Pa., or from official depositories.	Not for sale.	Office of Minerals Reports, Bureau of Mines, U. S. Department of the Interior, Washington 25, D. C.
Navy Department	19 information and public relations films and 428 training films.	Borrow public relations films from Navy Department, Washington, D. C. or from Naval District Headquarters. Rent training films from some educational film libraries.	Public relations films not for sale. Purchase training films from Castle Films.	Office of Public Relations, Navy Department, Washington 25, D. C.
Pan American Union	4 information films on Latin America.	Not for loan.	From Pan American Union.	Visual Education Section, Pan American Union, Washington 6, D. C.
Public Health Service (Federal Security Agency)	19 information films on health, sanitation, and medicine.	Borrow from State or local health departments.	Obtain authorization from Public Health Service.	Surgeon General, U. S. Public Health Service, Federal Security Agency, Washington 25, D. C.
Bureau of Reclamation (Department of the Interior)	7 information films on the Hoover Dam and reclamation in the West.	Borrow from Bureau of Reclamation, Washington, D. C.	Obtain authorization from Bureau of Reclamation.	Bureau of Reclamation, U. S. Department of the Interior, Washington 25, D. C.
Soil Conservation Service (Department of Agriculture)	24 information films on soil and water conservation.	Borrow from Regional Offices of the Soil Conservation Service. Rent from some educational film libraries.	From Castle Films.	Education Section, Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C.
Tennessee Valley Authority	16 information films on activities of the TVA.	Borrow from Film Services, TVA, Knoxville, Tenn.	Not for sale.	Film Services, Tennessee Valley Authority, Knoxville, Tenn.
Treasury Department, Savings Bonds Division	2 general-interest films on America, with "buy-bond" trailers.	Borrow from State Offices of U. S. Savings Bonds Division.	Not for sale.	Savings Bonds Division, U. S. Treasury Department, Washington 25, D. C.
Veterans Administration	12 films on veteran's activities and programs.	Borrow from the Visual Aids Division' Veterans Administration, Washington, D. C. or from the Regional Offices of the VA.	Not for sale.	Visual Aids Division, Veterans Administration, Washington 25, D. C.

[1] As of November 26, 1948.
[2] Various regional offices, depositories, and other distributors are listed in "A Partial List of 16mm Film Libraries," compiled and published by the U. S. Office of Education.

Courtesy Educational Screen

Salesmanship and Operating Activities. 50¢. 1943. Personnel Group, National Retail Dry Goods Association, 101 West 31st Street, New York City.

14. Educational Film Guide, H. W. Wilson Company, New York. Annual with monthly supplement. This is the outstanding guide to films in all fields. The subscriber receives a monthly list of current films with a brief description of their contents.
15. The Educators Guide to Free Films. Annual. Educators Progress Service, Randolph, Wisconsin. $4.00. An annotated list of more than 2500 rent-free films and film strips.
16. Film Utilization Guide—University of Michigan, Bureau of Visual Education, Ann Arbor. 1922. 726 p.
17. Fire Prevention and Protection in the United States. 7 p. Free. 1943. Committee on Visual Instruction, National Fire Protection Association, 60 Batterymarch Street, Boston, Mass.

    Forty-seven films (16 mm and 35 mm) on fire prevention and fire protection.
18. Free Film Source Directory. DeVry Corporation, 1111 Armitage Avenue, Chicago, Illinois. 50¢.
19. Guide to United States Government Motion Pictures. Motion Picture Division, Library of Congress, Washington, D. C. 40¢
20. Health Films. 35 p. 25¢. 1943. American Film Center Inc., 45 Rockefeller Plaza, New York City.

    List of 219 (evaluated) motion pictures that seem to be of value in the teaching of health.
21. Index to Training Films, 1947 edition. Business Screen, Inc., 157 E. Erie Street, Chicago, Illinois. 50¢.
22. Library and Related Films. 9 p. mimeographed 1941. Free American Library Association, 520 North Michigan Avenue, Chicago, Illinois.
23. Motion Pictures for Adult Education—T. R. Adam. American Association of Adult Education, New York, 1940.
24. Motion Pictures in Physical Education—T. R. Adam. Bureau Publications, Teachers College, Columbia University. 1939.
25. Motion Pictures Owned by or Relating to the American Railroads 20 p. Free. 1942. Association of American Railroads, Washington, D. C.
26. 1000 and One. Educational Screen. The Blue Book of Non-Theatrical Films. Educational Screen, 64 East Lake Street, Chicago, Illinois.

    A complete list of non-theatrical films from all sources. Classifies the films under 155 subject groups. Contains information about the number of reels, size, sound or silent and whether free or rental.
27. Recommended Films on Food and Nutrition. 25¢. 1945. New

York City Food and Nutrition Program, 45 Lafayette Street, New York, New York.

Enlarged and revised edition of "First Official List of Motion Pictures on Food and Nutrition."

28. Safety Film Catalog. 43 p. Free. 1942. National Safety Council Inc., 20 North Wacker Drive, Chicago, Illinois.

Lists motion picture films and slidefilms under such headings as fire prevention, first aid, industrial, vehicle traffic, public safety.

29. Safety Films for A.A.A. Clubs and Schools. Free. Revised May 1, 1943. Traffic Engineering and Safety Department, American Automobile Association, Washington 6, D. C.

Organized into groups according to elementary, high school, adult levels.

30. Selected Educational Motion Pictures, American Council on Education, Washington, D. C. 1945. Here are listed about 400 films which have been tried out in a number of schools. A complete description of each film is given.

31. Selected Films for American History and Problems. Hartley, William H., New York: Teachers College Bureau of Publications, 1940. Supplement, 1945.

A list of films arranged topically.

32. Selected List of Films for Pre-Flight Aeronautics. Teachers College, Columbia University—Macmillan.

33. Selected Motion Pictures, Brandon Films, 1600 Broadway, New York 19, N. Y. (Sale or rental.)

34. SVE Educational Motion Picture Catalog. Society of Visual Education, 100 Ohio Street, Chicago, Illinois. Free.

35. Sound Pictures in Science Instruction—Rubon, P. J., Harvard University, 1933.

36. Sources of Educational Filmstrips, and Sources of Educational Slides. Division of Audio-Visual Instruction Service, National Education Association, 1201 Sixteenth Street, N. W., Washington 6, D. C.

37. Sources of Visual Aids and Equipment for Instructional Use in Schools. U. S. Department of Education, Washington, D. C., Pamphlet No. 80, 1941. Rev. ed.

38. Sports, Physical Education and Recreation Film Guide. The Athletic Institute, 209 S. State St., Chicago 4, Illinois. 1947. 50¢.

39. Teaching Aids Service, New Jersey State Teachers College Library, Upper Montclair, N. J.

40. United Nations in Films. United Nations Information Office, 610 Fifth Avenue, New York 20, N. Y. Free.

41. Visual Aids in Safety Education. 32 p. Free. 1940. Safety Education Projects, Research Division, National Education Assn., 1201 16th Street, Washington, D. C.

Lists 156 motion pictures, 24 sound slidefilms, 14 filmstrips, 18 sets of lantern slides. Sources of safety posters are also listed.

CHAPTER XII

Handling, Maintenance, and Storage of Films

Teachers should avoid the error of cluttering up their classrooms and shops with miscellaneous visual aids. The shops and classrooms should have a pleasant business-like appearance conducive to the development of orderliness and good taste. If the walls and cabinets are littered with teaching materials, a poor example is set for the students. Visual aids to be effective should be shown only when needed and filed or stored when not in use. This suggestion should be followed not only for the sake of good housekeeping but also because it is in line with the accepted psychology in the use of visual aids—showing one at a time.

The careful handling and storage of films are most important. If the film is not in perfect condition, the scratches and imperfections are magnified on the screen and consequently distract from the showing.

Handling the Film

If the film has been borrowed from the film center of the local school system or from a manufacturer or a film distributor, do not rewind it. Films are always inspected when they are returned to the source of distribution for damage. Therefore, it is a convenience to the distributor if the film has not been rewound after use.

It is well to attach 4 to 6 feet of customer's leader to the beginning of the film and 2 to 4 feet at the end. The leader serves a dual purpose. It carries the name and number of the film and permits the film to be threaded easily without damage to the forepart. The words "start" and "end" should be printed on the respective pieces of leader.

Filing, Storage, and Accessories

Films come in metal containers and should be replaced in them immediately after use. With proper care, films will last indefinitely.

Always rewind the films that are the property of your individual school before storing them away so that they will be ready for the next showing. Glass slides should be replaced in their proper order in special filing boxes. Catalogs of projection equipment show a wide variety of filing and storage equipment from which to choose. In Chapter XV, Equipment for Visual Aids Center, will be found illustrations of suggested storage equipment. Much of the needed equipment can be easily made in the school workshop.

Special care should be exercised in handling films and slides. The following suggestions will be helpful in avoiding difficulty:

1. Store films in metal containers to avoid dust and damage.
2. Keep slides in slide case to prevent breakage and to insure their proper sequence.
3. Handle films and slides by edge only. Avoid finger marks.
4. Remove dust and lint with soft cloth dampened with carbon tetrachloride.
5. Re-run the film through a dry, clean, soft cloth to polish it.
6. Avoid scratching the emulsion on films and slides as nothing can be done to restore it.
7. Prevent oil from touching films.
8. Avoid extremes of heat and humidity.

Film should be stored in an atmosphere of not over 60°F. to prevent dryness and brittleness. Since this is not always possible, special treatment must be given to prevent excessive damage. It is possible to make a humidifier out of a storage can by placing a blotter well dampened with water inside the lid. Several hours of this treatment may be sufficient in most cases to compensate for undesirable atmospheric conditions.

Film Damage, Causes, and Repair

The remedies for the difficulties encountered in handling film are evident in almost every case, with the exception of torn sprocket holes. The repair necessary in this case is explained below.

Causes of Film Damage

1. Scratches
    a. Duty rollers or gate.

   b. Film riding take-up reel.
   c. Dragging film on floor.
   d. Improper storage.
2. Torn sprocket holes.
   a. Loss of loops.
   b. Tension too great on gate.
   c. Tension or jerking of take-up reel.
   d. Worn sprockets.
3. Sprocket holes on film or sound track.
   a. Sprocket teeth not properly engaged.
   b. Running a sound film on silent projector.
   c. Film reversed—improper threading.
4. Breaks.
   a. Sudden jerk of take-up reel.
   b. Inadequate allowance for loops.
   c. Faulty splice.
   d. Film not properly placed in film channel.

Repair of Film

Sometimes sprocket holes will be torn or the film may be nicked. In either case repairs are necessary to prevent greater damage. The film should be cut and spliced. If it is a sound film, the removal of 8 to 10 holes may affect the sound track. The removal of too many frames of a sound film will affect the continuity. If only one sprocket hole is damaged, it may be notched out with a notcher or a small V may be cut with a pair of scissors to remove the damaged hole. If the tear runs into the picture, then the film should be cut and spliced.

Splicing Film

When using motion pictures, a film splicing kit is necessary to repair any damage to the film and to join reels together, if necessary. The splicing job must be carefully done so that the two ends, when cemented together, will be in proper register. Two methods are commonly used in splicing—diagonal and at right angles as shown in Figure 12-1. The diagonal method has the advantage of operating more smoothly when passing through the projector. It also has less tendency to separate. The operations are:

1. Cutting both ends.
2. Cleaning the emulsion from one end.
3. Applying the cement.
4. Holding the films in contact and in proper register while the cement sets.

A good splice will result from the observance of the following points:

1. Ends must be cut squarely and smoothly and as near to the sprocket hole as possible. After both ends have been properly cut, the two pieces of film should be placed in the splicer with the emulsion side up.

12-1. Shows methods of cutting film when splicing.

2. The one end should be moistened so that the emulsion may be removed easily from the point of splicing. The scraping must be thoroughly done, but not to the point of weakening the film—particularly at the perforations.
3. The next step is the application of a light coat of cement. The proper amount of cement must be used. Too much will distort the film and too little will not allow the two ends to cement together. Special film cement is necessary for this purpose and requires 8 to 10 seconds to set. The film cement partly dissolves the film base, thereby joining firmly the two film surfaces. The cement is not effective through the emulsion; therefore it must be scraped from one end before splicing. Cement that becomes thick or cloudy in appearance should not be used. The cement bottle should be closed to avoid thickening due to exposure to air.
4. Sufficient pressure must be applied immediately after the cement is spread.
5. The completed splice should be aligned at the edges, the per-

forations should match, and the overlapping area should be joined tightly. The excess cement should be removed from both sides of the film.

Storage Equipment

Proper storage of film is a big factor in the life of film. It is economical to purchase steel cabinets designed for this particular purpose in lieu of makeshift cupboards and improvised shelving. The following cabinets are described and illustrated as suggestive of desirable equipment.

A film-strip storage cabinet is necessary to protect, to preserve, and to file film properly. Figure 12-2 shows a steel cabinet which is

12-2. Slide film storage cabinet humidified, dustproof, fireproof and indexed. (*Courtesy Neumade Products Corp.*)

12-3. Six-drawer film-strip steel cabinet. (*Courtesy Neumade Products Co.*)

dustproof, fireproof, and humidified. It will hold 34 100-foot reels of 35-mm film strip. Figure 12-3 shows a cabinet that will accommodate 300 of the 1½-inch paper-labeled lid cans commonly used for 35-mm strips.

Motion picture file cabinets are needed whenever there is a sufficient number of films in a single center to justify the expenditure. The type to be purchased depends on the particular situation in which they are used. The illustrations shown are representative types of available units.

A school or business with a growing library of motion picture films will find the cabinet in Figure 12-4 ideal.

A de luxe cabinet is shown in Figure 12-5 which has a capacity of 50 400-foot reels. It has five rigid shelf surfaces each holding a ten-compartment cabinet. Size: 26 inches wide, 11 inches deep,

70 inches high. This style is fireproof, dustproof, and higher in price than the others shown.

The cabinet shown in Figure 12-6 will accommodate 100 reels with a capacity of 400 feet each. The compartment in the base is very convenient to store projection apparatus. The drawer carries a humidor which humidifies the entire cabinet. Over-all size: 72

12-4. A sectional cabinet for motion picture film. Capacity 20 400-ft. reels—humidifier. (*Courtesy Neumade Products Corp.*)

inches high, 28½ inches wide, and 11 inches deep. This unit may be purchased with two additional racks in lieu of the above compartment, in which event the capacity is increased to 140 reels.

If a fireproof and dustproof room is used for storing film, it is possible to use the style of open rack shown in Figure 12-7. It is relatively less expensive than the other types illustrated, and will hold 250 400-foot reels. The unit shown is 72 inches high, 48 inches wide, and 10 inches deep. It is possible to purchase this rack in sizes to suit individual specifications for installing in present library stacks.

A Visual Aids Cabinet

It is highly advantageous to have a suitable cabinet in which to store projection equipment, film, slides, and accessories. The cabinet shown in the accompanying illustration appears to be adequate for the projection room of a high school or a teacher training institution. An examination of the pictures and sketches gives evidence of its convenient features.

12-5. De luxe motion picture file cabinet. (*Courtesy Neumade Products Corp.*)

It did not seem advisable or necessary to provide space within the cabinet for the motion picture machine. This piece of apparatus is usually too heavy and too inconvenient to handle readily, and therefore a permanent place on top of the cabinet seems logical. A suitable cloth hood should be provided to protect the machine from dust and injury.

There are several features of the cabinet that are not apparent from an inspection of Figures 12-8 and 12-9.

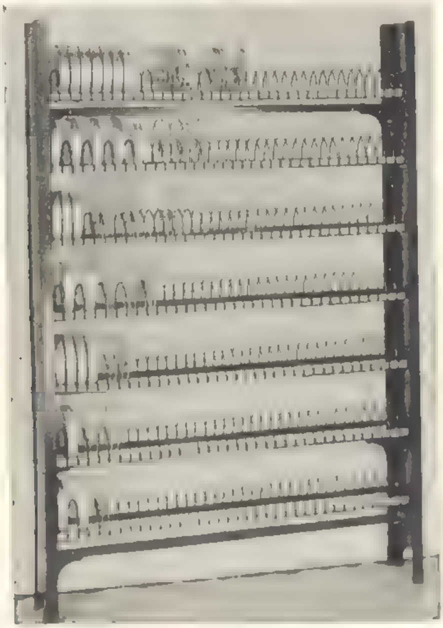
1. It is on rollers and may be easily moved to any desirable location. A door stop has been placed at a convenient point so that the user can anchor the cabinet wherever desired.

12-6. **Motion picture and equipment storage cabinet** (*Courtesy Neumade Products Corp.*)

2. The drawers (6) and (7) are provided with grooved partitions to permit the filing of the 3¼″ x 4″ and 2″ x 2″ slides, respectively.

3. In the lower right-hand corner outside section D will be found the receptacle for the feed line to the cabinet. In the upper part of the same section will be found a three-way outlet connected to the intake line which will enable the operator to have ready for immedi-

ate use the motion picture machine, a film-strip projector, and a slide projector. Such a combination is frequently desirable in the presentation of a topic with the modern projection equipment. It is possible to shift from one projector to the other without a loss of time and inconvenience because the electrical connections have been made prior to the showing. It requires only the snapping of the switch on each individual machine. This arrangement necessitates



12-7. Open file rack for motion picture reels. (*Courtesy Neumade Products Corp.*)

only an extension cord from the wall or service outlet to the cabinet, which is a considerable advantage when the cabinet is being used in a location not near the service outlet.

A modification of this design will satisfy almost any school situation. Adjustments of the space should be made in accordance with the projection equipment to be stored. Provision for the motion picture machine could be made also without changing the basic design of the cabinet. The majority of school woodworking shops will find this cabinet a worth-while project to develop as it is within the ability of the students and the range of school shop equipment.

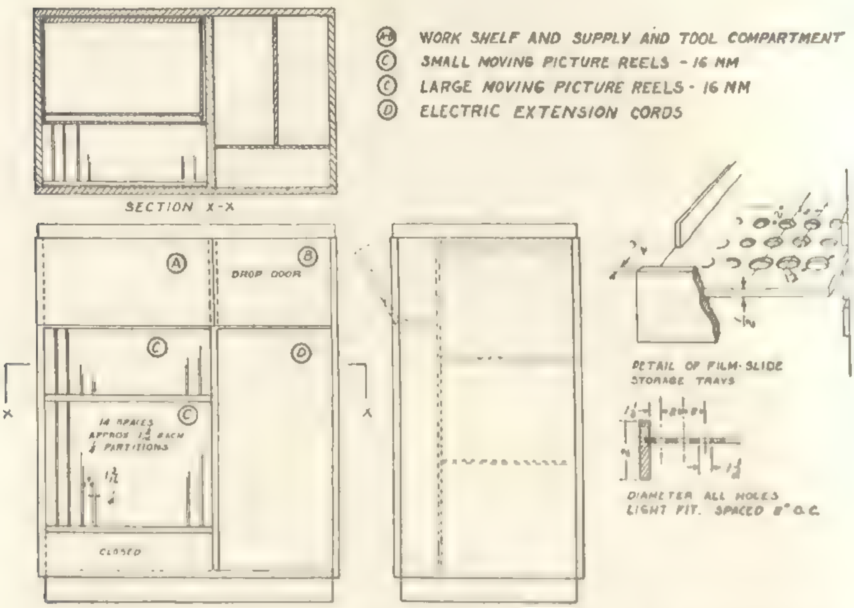
12-8. Projection cabinet (left side view with dimentioned sketches).

A. *Storage space*
B. *Repair kit*
C. *Motion picture can storage* (28)
D. *Storage—extension cable—etc.*

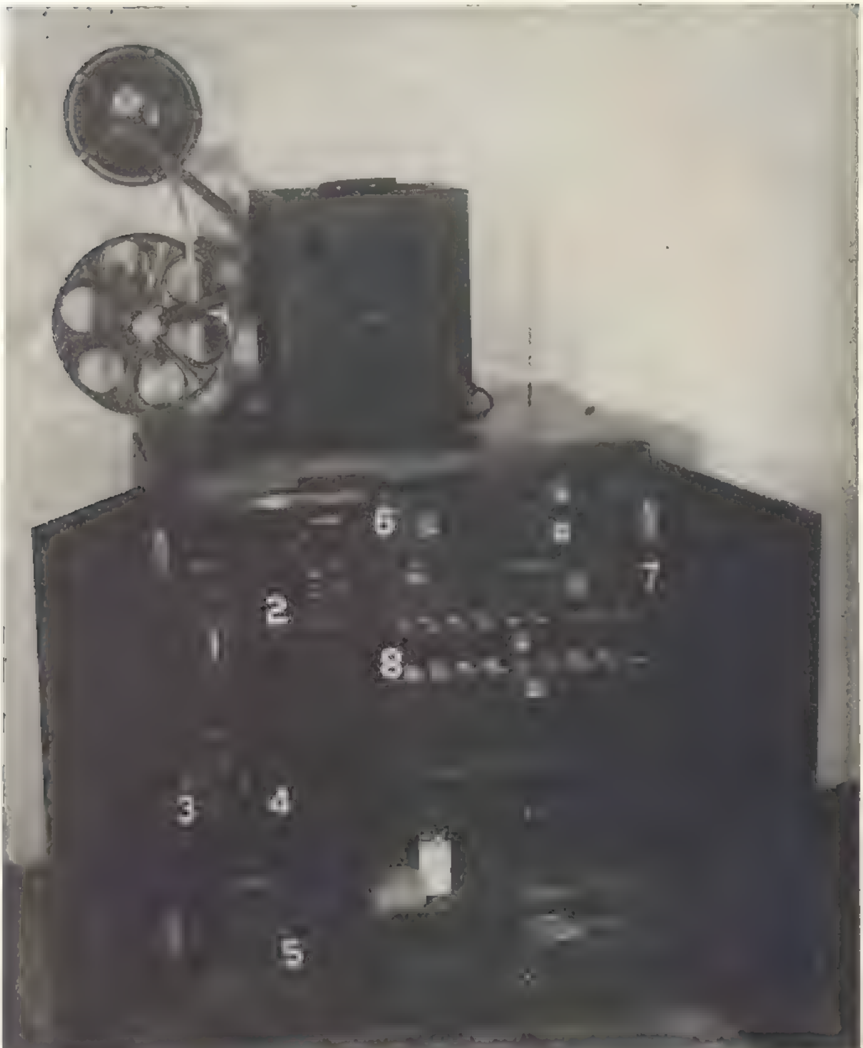
The convenience of such a cabinet and the protection it gives to the equipment more than justify the expense involved in its construction.

Handling Films within the School

Many school administrators will answer in the affirmative when asked whether or not they use films in their schools. But when questioned further it is discovered that the films serve as an entertainment diversion or interlude in the regular routine teaching procedures rather than an effective teaching aid.



Despite any favorable disposition of the school administrator to the use of these teaching aids, the success or failure of such a program rests with the methods utilized by the various shop and classroom teachers. The number of films used, in many cases, is in direct proportion to the ease with which the average teacher can secure them for use. The use of films in all cases should be integrated with the subject matter and objectives of the courses of study. Therefore, it is necessary to make an analysis of the material to be taught and the available films on the subject under consideration. After this phase of the task is completed, the further development of



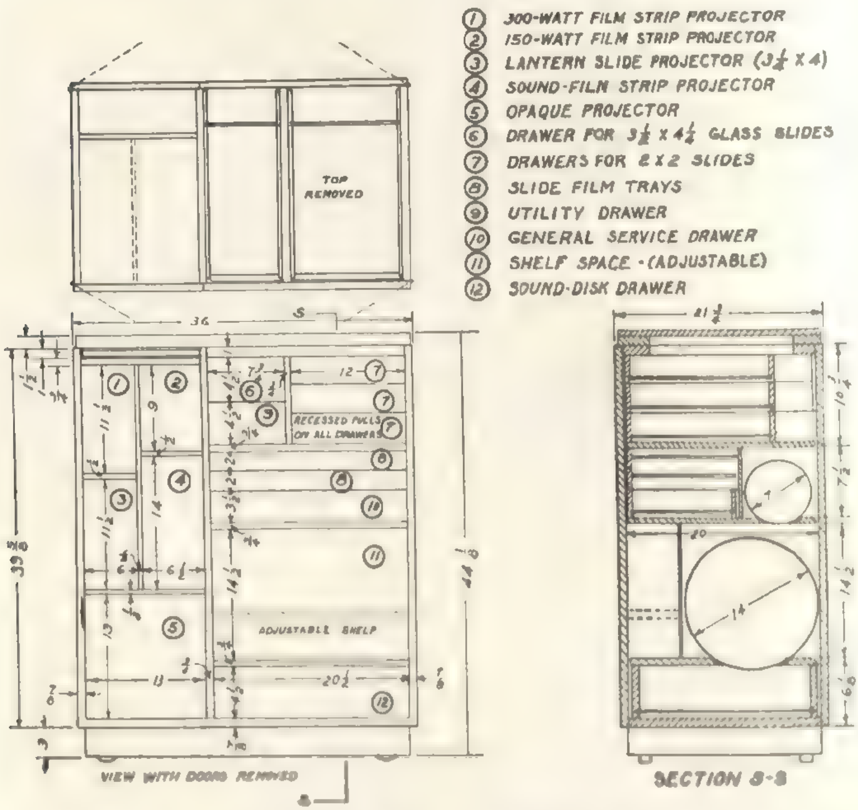
12-9. Projection cabinet (right side view with dimentioned sketches).

1. *S.V.E. 300 W. film strip projector*
2. *S.V.E. 150 W. film strip projector*
3. *Lantern slide projector 3¼ x 4 in.*
4. *Sound strip film projector*
5. *Opaque projector*
6. *Drawer for 3¼ by 4 in. slides (2)*
7. *Drawer for 2 by 2 in. slides (3)*
8. *Slide film trays (2*

a program of visual aids depends on the alertness and initiative of the individual teacher.

Factors That Inhibit and Promote the Use of Classroom Films

The greatest value to be derived from projected pictures is their use in the regular classroom at the time when there is the greatest



need for visual assistance to explain a difficult point and provide information relevant to the lesson. If the showings are confined to one or two rooms within a building, there are definite restrictions placed on the usage of projected aids. Furthermore, it is disrupting to change rooms because of the resulting discipline problems. The time may come when projectors are available with "rear projection," which will permit their use in all shops and classrooms without darkening the room. When the regular classroom is used, the nor-

mal atmosphere will not be disturbed and the feeling of having attended a "movie" will be nonexistent. The whole situation is then one of normalcy and the lesson is conducted under the usual instructional conditions without any distractions.

Until such times when ideal conditions exist, there is need for solving the immediate problem of using films in the classroom. In many schools a special room has been reserved and generously equipped for all projection purposes. A regular faculty member has been placed in charge of room reservations and film distribution. Such a room is justified in three ways.

1. The showing of motion pictures requires a special setting. The room must be dark and acoustically treated.
2. The complicated sound motion picture machine cannot be moved easily and furthermore should be operated by persons trained for the purpose.
3. It would be inadvisable financially to equip every classroom for the showing of motion pictures.

These are three very good reasons for the use of a special projection room as far as motion pictures are concerned. Although motion pictures are playing an important part in vocational education today, the film strip promises to play the major role in the day-to-day teaching of trade, technical, and industrial arts work. It is, therefore, necessary to consider the use of the film strip from the standpoint of the average teacher. It is reasonable to assume that the average teacher is acquainted with the available films in his field of work and is willing to use them for instructional purposes. Unfortunately, he encounters certain difficulties in the use of the desirable films and consequently assumes a passive attitude resulting in nonuse of these valuable teaching aids. Let us analyze the situation in order that the inhibiting factors may be discovered and suggestions be made to eliminate them.

In the first place the use of film should be correlated with the period of greatest need for particular instruction. The teacher must estimate the time when his class or group will be ready for the film showing. According to his best judgment, he decided that Tuesday morning appears to be the opportune time and he consequently submits his request for the use of the facilities of the special projection

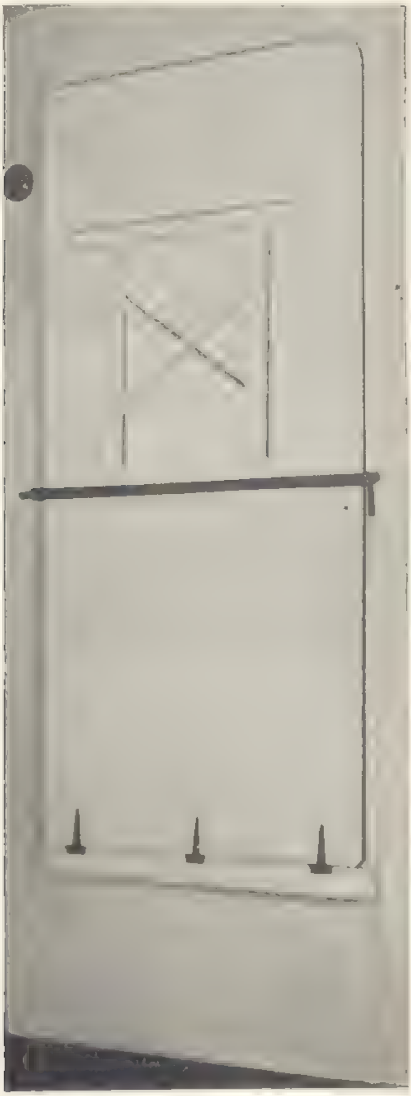
room. He is advised that no time is available between Monday morning and Thursday afternoon. Reluctantly he accepts Thursday as the lesser of two evils with the hope that he may be able to retard his instruction or rearrange his instructional sequence to avail himself of the films at the designated time. Immediately his enthusiasm is leavened. In the interim he cannot conscientiously change his instructional program and consequently the film will be shown Thursday although it should have been presented on Tuesday when the time of greatest need existed. This kind of experience has tended to dilute the interest and enthusiasm of teachers for the use of films as teaching aids. This situation is frequently met with in a large school where there are many requests from teachers to show the numerous interesting films available on practically all school subjects.

There is also another situation that tends to discourage the use of film in a special projection room by the average shop and classroom teacher. This involves the use of the projection apparatus. In this case it has been possible to reserve the room on the day and hour desirable, but, upon the arrival of the teacher with his class, it is discovered that the projector has been broken, or a part is missing or otherwise not in working order. Consequently, there is considerable delay in starting, and in the meantime discipline problems naturally develop. The sum of these difficulties means discouragement and antagonism toward film use.

The question immediately is asked, "What is the solution to these problems?" There may be no panacea to all these difficulties, but several suggestions may be offered which might alleviate individual difficulties.

1. Confine the central projection room to the showing and storage of motion pictures only.
2. Instead of the centralization of all film storage, permit each instructor to retain in his own department, the film strips that pertain to his particular subject. The instructor in this case is responsible for the films and he has them available for immediate use when the teaching situation requires it.
3. In place of one high-priced film-strip projector for the projection room, purchase inexpensive projectors so that every instructor will have his own. It may be convenient to assign

two instructors in adjacent departments to each projector. This arrangement will reduce to a minimum the difficulty of lost or broken parts as well as definitely place the responsibility for the equipment. There are on the market satisfactory film-strip projectors for less than $30 that are adequate for groups



12-10. Projection table when not in use.

of 30 or less. The time is rapidly approaching when a film-strip projector will be a part of almost every teacher's instructional equipment.

4. Substitute an ordinary, white window shade in the classroom or shop for the more expensive screen of the projection room.

12-11. Projection table when in use with the collapsible shadow box in the working position.

These few suggestions will tend to eliminate the inhibiting factors which prevent the wider use of films for instructional purposes.

However, there is a need for additional facilities in the school shop for showing films. This equipment should be convenient and as simple as possible. These desirable features are embodied in the apparatus shown in Figure 12-10. The board or table may be compared with the wall ironing board in the modern home. It is hinged to the wall and may be dropped to position for use when needed. It is 48″ x 96″, which is large enough to accommodate eight students, if it is desirable to take notes.

There may be many times when the entire class is not concerned with a specific film, in which case the class or shop room should not be darkened, thus allowing other students to continue their work without interruption. To overcome the objection of interference of light and pulling down of shades, a shadow box made of press-board has been placed at the end of the table against the wall. The sides and top of this shadow box are painted black in order to increase the visibility of the picture and reduce the interference of daylight. It will allow the showing of a picture approximately 16″ x 25″. (See Figure 12-11.) The shadow box (40″ x 24″ x 10″) is placed in a fixed position, but the top and sides are hinged in order that it may be collapsed and laid flat against the wall behind the board when it is not in use.

This is an inexpensive arrangement, easily made in the school shop and convenient for use; it requires limited space and is within the control of the individual teacher. It is to be recommended for individual shop use wherever film strip is used.

References

Films

1. "Facts about Film," International Film Bureau, 6 No. Michigan Ave., Chicago, Ill. 16 mm; sound; B & W; 10 minutes; $50.00.
   Explains the proper use, maintenance, and storage of film.

Article

2. Grobow, Wesley J. F., "A Story About Film Damage," *Audio-Visual Guide,* March 1949, p. 18.

CHAPTER XIII

Films for Vocational and Technical Schools—Kinds and Use

It is not the purpose of this book to include a discussion of all existing kinds of films. Therefore, the number has been confined to five types, those of most concern to teachers in the field of vocational and technical education. They may be classified as follows:

A. Occupational Film
B. Industrial Film
C. Technical Film
D. Scientific Film
E. Skill Film

The following pages present suggestions for the use of these various types of vocational and technical films. The procedures outlined follow a general pattern but vary with the particular type of film. The recommended general outline of approach is:

STEP 1. To explain the purpose of the film by showing its relationship to the topic or lesson under discussion.

STEP 2. To review certain information about the topic already known by the students. Challenge the students with certain questions pertinent to the topic. List the key points on the blackboard.

STEP 3. To direct the observation of the students by indicating certain specific points they should note while viewing the picture.

STEP 4. To show the picture one, two, or more times, depending on the complexity and length of the film. The first showing may be for a general over-all view. The second showing may be for the observation of definite details.

STEP 5. To follow up the original showing. Immediately following the showing of the film, the teacher should pose certain thought-provoking questions which will stimulate further interest in the subject and lead to a more thorough understanding. In some cases, it may be advisable at this point to show the film again for review or summary. The amount and type of discussion will depend on the purpose for which the film was shown.

STEP 6. To give specific assignment of work to be done, references to be read, or reports to be submitted in order that the information acquired from the film may carry over into the activities of the student.

A. Occupational Films

This type of film pertains to the activities of a trade or technical occupation and centers attention on the worker and what he does. Its chief value is informational. Such a film usually shows the worker performing various hand skills and operating the different machines in a particular occupation. A few examples of such films are:

1. "The Furniture Craftsman"
2. "The Etcher and His Art"
3. "Lumberjacks of the Maine Woods"
4. "The Journalist"

These films, as well as similar films, are to be recommended for use in vocational guidance and as introductions to the work in specialized vocations.

The following suggestions will help the teacher to secure maximum educational returns for the use of the occupational film "The Furniture Craftsman." This film might be used with a group of students studying occupations or it may be used to motivate the interests of the students in a woodworking department during the construction of furniture projects. The procedure in each case would be practically the same, but the questions might vary in accordance with the purpose for which the picture is shown.

Assume that you wish to show this film to a group of boys in a woodworking department. Let it be further assumed that a number

of furniture projects are to be constructed. The following steps in the use of this picture are recommended:

STEP 1. Give a brief talk on the various periods of furniture with the distinguishing features of each, the fine hand work performed, demand for such work, and compensation paid to craftsmen.

STEP 2. Challenge the students with questions, such as:
- a. What particular skills must a craftsman develop to produce fine furniture?
- b. What personal characteristics do you think such a craftsman must possess?
- c. Where are such craftsmen employed?

STEP 3. Indicate special things to be observed in this picture, for example,
- a. Note the care exercised by the craftsman in performing his work.
- b. Observe how carefully he protects his tools.
- c. Look for the special tools used to perform certain operations.
- d. Does the mechanic appear to do his work with ease and confidence?

STEP 4. Show the picture. Be sure the projector is properly placed, the focus adjusted, and the first frame in position. Comment on the work of the craftsman as the picture is being shown. Point out the important features of the work.

STEP 5. Follow up. Immediately following the showing, use follow-up questions such as:
- a. Identify the period of the piece of furniture in the picture.
- b. Where have you seen similar pieces of furniture?
- c. What impressed you about the craftsman's work habits?
- d. Did the worker exercise any particular safety precautions?

STEP 6. Assign reference reading and request a report to follow a certain predetermined pattern, for example,
- a. List three different periods of furniture and give the distinguishing feature of each.

b. How did the period derive its name?

c. State several outstanding craftsmen who are known for their unusual workmanship.

d. Where are examples of these periods to be found in the locality?

e. Is there any relationship between the furniture of the period and the customs and social life of the people?

STEP 7. During a succeeding group meeting request that one or two of the better reports be read before the class. It is advisable to summarize the outstanding points of the reports to emphasize the important facts.

B. Industrial Films

The films to be included in this classification are those depicting manufacturing processes. There are many films of this kind and they are usually produced by manufacturers and trade associations. Although they may be primarily a medium of advertising, nevertheless they are filled with information that is valuable to students in vocational schools. This classification includes such films as

1. "Electrically Welded Pipe"
2. "Manufacture of Cotton Cloth"
3. "Modern Shoemaking"
4. "The Story of Abrasives"

These films will give students an appreciation and an understanding of certain manufacturing processes and will familiarize them with a wide range of trade materials. They describe the fabrication of basic articles, mining operations, or the manufacture of commodities from raw materials. For example, the film "Making Steel" could be shown effectively by following the outline below for any of the several instructional purposes for which film might be used.

a. It might be used to inform a group of machine shop apprentices about the manufacture of steel and its variations in structure and use, or

b. It could be used to advantage before a class studying the materials of industry, or

c. It might be used in connection with the work of a class in foundry practice, or
d. It might be used in a course of metallurgy.

Although a different phase of the process of making steel would be emphasized in each case, the pattern suggested here for the presentation of the film would be applicable to all four teaching situations and would assure educational returns to the students.

STEP 1. Present a few preliminary facts about kinds of iron and steel and their uses. Demonstrate the difference between various kinds by the spark test. Write on the blackboard the names of common varieties. State that an interesting film will be presented to show how steel is manufactured. Invite student questions.

STEP 2. Show the picture. Be sure the projector is properly placed, the focus adjusted, and the first frame in position. In this case, as in many others, it may be advisable to show the entire film at this point without comment.

STEP 3. Explain that the picture was interesting, but more detailed information is needed; therefore, ask several thought-provoking questions, such as
  a. What do we mean by pig iron?
  b. Who can tell the difference between the use of cast iron and the use of wrought iron?
  c. What kind of iron metal would you recommend for cutting tools?

STEP 4. State that the picture will be shown again in order that the students' knowledge may be extended. Indicate special things to be observed in the picture.
  a. Note the different materials placed in the cupola.
  b. Observe how the impurities are removed.
  c. Pay attention to the protective clothing worn by the workers.
  d. Look for any supplementary materials added during the process.
  e. Note how the molten metal is removed from the cupola.

STEP 5. Show the film again with such "running comment" as is

necessary to emphasize or to clarify certain parts of the picture.

STEP 6. Follow up. Ask questions such as the following:

a. What transformed the iron into steel?
b. What is the difference between a "pig" and an ingot?
c. What treatment can be given to cast and wrought iron to make their surfaces as hard as tool steel?
d. What are the advantages of using wrought iron in place of cast iron?
e. What is the difference between ordinary tool steel and high-speed steel?

STEP 7. Assignment. Request reports on the following points:

a. The variation in tensile strength of cast iron, wrought iron, and steel.
b. Metal alloys that have greater strength than steel.
c. The difference between regular tool steel and high-speed steel.
d. What is meant by *case hardening* and how is it done?
e. A talk with a steel maker or a metallurgical engineer about steel and steel products.

Note: Specific references to reliable texts on the subject should be given.

A visit to a steel mill would be an excellent follow-up.

C. Technical Films

These films, as the name indicates, contain technical information and data necessary to understand a measuring tool, the application of formulae, or the operation of a device based on scientific principles. In this group the following films may be included:

1. "How the Micrometer Works"
2. "Estimating Gear Dimensions"
3. "Operation of the Steam Turbine"
4. "Refining Crude Oil"

These films are highly recommended as visual aids for the teacher's use. It is often impossible to bring to the school certain ma-

chinery, devices, and actual processes of production. In a majority of such cases, the movie will compensate for the real thing and thereby enable the students to acquire the desirable information.

This type of film shows application of mathematics and science to certain mechanical operations in the production of manufactured goods. It accomplishes its purpose by the use of animated sketches, mechanical drawings, and by showing how mathematical formulae are applied.

The following procedure is suggested in the use of a technical film such as "The Cutting of a Spur Gear."

The showing of this film would naturally be preceded by a general discussion of kinds of gears such as spur gears, bevel gears, and worm gears. Let us suppose the trainees are at the point where they are ready for instruction on the actual cutting of a spur gear, which is the simplest form of gearing.

STEP 1. The instructor should review briefly some of the information about gears already presented to the students with the added statement that the film about to be viewed will show the practical application of what they have previously learned.

STEP 2. The instructor should give the following directions for an intelligent viewing of the picture.

a. Note where the pitch line is located on which the width of the tooth is measured.

b. Be sure to observe the location of the addendum, the dedendum, and the clearance.

c. Observe carefully and remember the relationship of the number of teeth to the diametral pitch expressed in the formula: $P = \frac{N}{D}$.

d. Note how the outside diameter of the gear and the depth of the teeth are calculated.

e. Pay particular attention to the manner in which the proper cutter is selected by the use of a standard handbook.

STEP 3. Show the film up to the point where the use of the dividing head is presented. The amount of information already presented is enough for one lesson and should be reviewed

and emphasized by the instructor before going further with the film.

STEP 4. At this time the instructor should develop several similar problems on the blackboard to familiarize students thoroughly with the use of the formula given in the picture.

STEP 5. The film should be shown again from the beginning. The showing should be preceded by several suggestions on what to observe in the new material that is concerned with the setting of the dividing head and the mounting of the gear blank for cutting. The following directions will be helpful:

a. Remember the ratio of turns between the crank on the dividing head and the spindle.
b. Attention should be given to the manner in which the dividing head is set for indexing.
c. Note the care with which the operator works to avoid error.
d. Observe the way in which the gear is nicked to check the setting of the dividing head.

Note: At this point, it might be advisable to stop the film and have the students actually cut a gear according to the procedure shown in the picture. The balance of the film pertains to the cutting speeds and feeds and may be deferred for later instruction. The learner has so much of importance to observe and remember that the instructor should set the speed and feed for the job at this time and not delay the students' activity of setting the machine and cutting the gear.

The remainder of the film could be shown at a later date as a unit of instruction in itself or it may be shown immediately after the student has cut the first gear but before he starts work on a second gear cutting job.

STEP 6. Follow up. Invite questions from students in order to clarify points that are not completely understood. Following the discussion of the film, the instructor should give the learner a gear blank to be cut. The learner should be required to make all calculations, select the cutter, and set the machine to be checked by the instructor.

Note: The instructor may choose this point as the place to show the remainder of the film pertaining to cutting speeds and feeds. If presented at this time, the learner can set the speed and feed immediately after the film is shown.

STEP 7. Assignment. After the learner completes the cutting of the first gear, he should be assigned several jobs for which he would be required to make the calculations. The following problems are typical of such an assignment.

a. Make all calculations for a 10 pitch gear of 60 teeth. Indicate the dividing head plate required.

b. A gear of 4-inch pitch diameter and 8 diametral pitch is to be cut. Calculate depth of tooth, outside diameter, and required indexing.

D. Scientific Films

The films in this group are those which explain accepted theories. Instructors have difficulty in presenting clearly such a concept as the atomic theory of matter. The students experience an equally difficult time in comprehending such an abstract idea. This is especially true in the field of pure science as distinguished from applied science. During recent years, movie films have been produced that clarify in a most satisfactory manner scientific ideas which otherwise would remain very hazy. Teachers should make use of these available films because large educational returns accrue to the students. Films of this kind are:

1. "Aviation Meteorology"
2. "Discovery and Application of the X Ray"
3. "Sound Waves"
4. "Principles of Television"

The scientific film enables the teacher to explain clearly and effectively subjects that involve certain scientific principles. It is usually most difficult for students to think abstractly, and therefore any assistance the teacher may enlist will prove helpful. The motion picture will aid the students' learning if a definite procedure in the use of the film is developed. The following plan is suggested for such a film as "Sound Waves."

This particular picture might be used in the following teaching situations:

a. Teaching radio communications in a vocational or technical school.
b. Teaching a lesson on sound waves in connection with a class in high school physics.
c. Teaching principles of sound to music students.

STEP 1. Assume that the students have already studied the physics textbook and have learned the definition of such terms as pitch, frequency, etc.

STEP 2. Explain to the students that a motion picture will be shown to clarify further the material in the text concerning sound waves.

STEP 3. Show the film to give the students an over-all idea of its content.

STEP 4. After the preliminary showing, certain directions should be given for detailed observation before the film is shown again. Suggestions such as the following will aid the students' understanding:

a. Note the difference in the frequency of the sound waves for high and low notes.
b. Be sure to observe what controls pitch.
c. Think of your definition of the various sound factors as the picture is shown.
d. Pay special attention to the graphical explanation.

STEP 5. Show the film again in order that the students may observe more closely the basic principles underlying sound production. It may add further emphasis to the important phases of the picture if the instructor will use a pointer to supplement the running comment of the recorded voice. It may be advisable to show the film a third time before the class discussion of its content.

STEP 6. Follow up. The instructor should pose certain thought-provoking questions to stimulate class discussion:

a. On what does vibration depend?
b. What is the relationship between frequency and pitch?
c. What practical value has the oscillograph?

d. Explain how all musical instruments are constructed on the principle of sound theory.
e. How does music differ scientifically from noise?
f. Explain what we mean by harmonics.

STEP 7. Assignment

a. Make a list of machines, instruments, or things of use and convenience that are built on the theory of sound waves.
b. Discover whether or not any special research is being conducted in that field at the present time.
c. What are the activities of a sound engineer?
d. What value has the knowledge of sound waves in the practical field of acoustics?

E. Skill Films

Films that show how specific trade skills are performed come within this category. Very recently attempts have been made to develop films that will accelerate the learning of certain basic trade skills and of the operation of particular machine tools. It is not possible at this time to state with assurance whether or not these films aid definitely in the development of manipulative skills.

These films vary in subject matter although their primary purpose is the development of skill. One type of skill film is *introductory* in nature and may be used prior to individual instruction on skilled operations. It may be used also as a *review* or *summary*. "Operation of the Milling Machine" is a film of this type. It gives an over-all view of the operation of the machine but has doubtful value in developing the skills involved.

A limited number of skill films have been produced for training learners in performing a *unit operation*. "How to Grind a Drill" is one example. In this case, the film is short and is confined to the teaching of one operation. It is reasonable to believe that films of this kind will reduce the amount of time the instructor must devote to individual instruction. These films may prove to be very valuable if they are limited to unit operations. Examples of other films of this kind are:

1. "Wiping a Lead Joint"
2. "Bench Filing"

3. "Threading a Sewing Machine"
4. "How to Flare Tubing"

Another form of skill film is the one that shows *how to do a work job*. Films typical of this kind are:

1. "Grinding Valves"
2. "How to Cut a Keyway"
3. "How to Make a Buttonhole"

The skill film type of movie and film strip that illustrate manipulative procedures and trade skills will continue to increase in number as they are of particular value in vocational and technical schools. They serve as a fine supplement to the teacher's explanation and demonstration, but they cannot replace the teacher. They are of particular value only to introduce, review, or summarize the teacher's instruction.

Since the skill film is one that shows how to perform certain manual skills, it should be used as an introduction to training in new skills. It may also be used advantageously during the training period to correct certain incorrect notions about the performance of an operation. The following procedure is recommended for the use of a skill film such as "Grinding a Drill."

STEP 1. Discuss the importance of a properly ground drill for speed and accuracy in doing machine work. Emphasize the need to develop skill in the performance of this operation. Show by a sketch on the blackboard the required angles of rake and clearance necessary to grind correctly a drill.

STEP 2. Explain briefly the content and purpose of the film to be shown. Suggest that careful attention be given to the position of the demonstrator at the grinding wheel, also the position and movement of the demonstrator's arms and hands.

STEP 3. Show the film without comments.

STEP 4. Explain that the film will be run again so that the demonstrator's position at the grinding wheel plus his arm and hand movements may be observed. During this showing

the instructor should give a running comment of what is being done. The following directions should be given:

a. Note the position of the demonstrator's feet and body in relation to the grinding wheel stand.
b. Observe the way he holds the drill and the manner in which he places his fingers on the tool rest.
c. Be careful to notice the wrist movement that insures the proper back rake for efficient cutting.

STEP 5. Immediately after the showing, allow each trainee to try grinding a drill. Watch him carefully and see that he performs the act as it was portrayed in the movie film. Give a personal demonstration, if necessary. Insist that the learner use a drill grinding gage to determine the accuracy of the grinding.

STEP 6. Assignment. Require each learner to use a reference on drills and drilling for information concerning:

a. Names of the parts of a drill. For example, web, lip, land, etc.
b. The difference in grinding for hard or soft metal.
c. Taper per foot on drill shank.
d. The grinding of a drill to produce an over-sized hole.
e. The recommended angles of clearance and rake.
f. The lubricants to be used when drilling.

Conclusion

Despite any minor difficulties, the alert and conscientious teacher will include films in his course building and lesson planning. The film is almost indispensable in a modern school and should be utilized whenever suitable film is available. The results are definitely dependent upon the manner in which the instructor handles the situation. An excellent film may be ineffective in the hands of a poor teacher, while a mediocre film may be made interesting and result in considerable learning if it is handled by an instructor who appreciates the possibilities of the film as a medium of instruction. All progressive teachers will secure training in the use of film and the use of projection equipment in order that they may take advantage of the great store of information and scientific knowledge available for the asking.

Commercial Organizations Distributing Films for Use in Vocational and Technical Education

1.	Abrasive Company	Tacony & Fraley Sts., Phila., Pa.
2.	Aetna Life Affiliated Company	Hartford, Conn.
3.	Allen Equipment Company	Kalamazoo, Mich.
4.	Allis Chalmers Mfg. Co.	Adv. Dept., Milwaukee, Wisc.
5.	American Brass Company	Waterbury, Conn.
6.	American Institute of Steel Construction	100 Park Avenue, N. Y. C.
7.	American Rolling Mill Co.	Middletown, Conn.
8.	American Sheet Metal & Tin Plate Co.	Frick Bldg., Pittsburgh, Pa.
9.	Amphibian Car Company	Buffalo, N. Y.
10.	Armstrong Cork Company	Lancaster, Pa.
11.	E. C. Atkins and Company	402 S. Illinois Street Indianapolis, Ind.
12.	Bell Aircraft Corporation	Buffalo, New York
13.	Bausch & Lomb Optical Co.	Pershing Sq. Bldg., N. Y. C.
14.	California Oregon Power Co.	Medford, Oregon
15.	Carborundum Company	Niagara Falls, New York
16.	J. I. Case Company	700 State Street, Racine, Wis.
17.	Caterpillar Tractor Corp.	Peoria, Ill.
18.	Champion Spark Plug Co.	904 Upton Avenue, Toledo, Ohio
19.	Chevrolet Motor Co.	Detroit, Mich.
20.	Cleveland Twist Drill Co.	1242 E. 49th St., Cleveland, O.
21.	Chicago Tribune	Tribune Sq., Chicago, Ill.
22.	Cincinnati Milling Machine and Cincinnati Grinders Inc.	Cincinnati, Ohio
23.	Colonial Beacon Oil Co.	30 Rockefeller Plaza, N. Y. C.
24.	Dierks Lumber & Coal Co.	Kansas City, Mo.
25.	E. I. DuPont Co.	Wilmington, Del.
26.	Eastman Kodak Co.	Rochester, New York
27.	Ford Motor Co.	3674 Schafer Road, Dearborn, Mich.
28.	General Electric Co.	Schenectady, New York
29.	General Motors	1775 Broadway, N. Y. C.
30.	General Railway Signal Co.	Rochester, N. Y.
31.	P. H. Glatfeller Co.	Spring Grove, Pa.
32.	Goodyear Tire & Rubber Co.	Akron, Ohio
33.	Great Lakes Dredge & Dock Co.	122 S. Michigan Ave., Chicago, Ill.
34.	Hamilton Standard Propellers	Union Aircraft Service Corp. Hartford, Conn.
35.	Hammermill Paper Co.	Advertising Dept., Erie, Pa.

36. Harris Seybold Potter Co.	451 E. 71st St., Cleveland, O.
37. Hercules Power Co.	Wilmington, Del.
38. Household Finance Corp.	919 N. Michigan Ave., Chicago, Ill.
39. International Assn. of Electrical Inspection	85 John St., N. Y. C.
40. International Shoe Co. Hy-Test Div.	St. Louis, Mo.
41. International Business Machine	590 Madison Ave., N. Y. C.
42. International Harvester Co.	606 S. Michigan Ave., Chicago, Ill.
43. John's Manville Sales Corp.	76 Forbes St., Pitts., Pa.
44. Kansas City Power & Light Co.	Kansas City, Mo.
45. Kearney & Trecker Corp.	Milwaukee, Wis.
46. Lake Shore Mines	Kirkland Lake, Ontario c/o Mr. C. E. McKnight
47. Liberty Mutual Insurance Co.	Park Square Bldg., Boston, Mass.
48. Lincoln Electric Co.	12818 Colt Rd., Cleveland, Ohio
49. Lindberg Engineering Co.	2450 W. Hubbard St. Chicago, Ill.
50. Lukens Steel Co.	G. M. Gillen, Coatesville, Pa.
51. Mass. General Hospital	Boston, Mass.
52. Mechanical Brickhandling Corp.	P.O. Box 239, Lancaster, Pa.
53. Melville Shoe Corp.	25 W. 43rd St., N. Y. C.
54. The Mercury Corp.	Indianapolis, Ind.
55. Modern Plastics Magazine	122 E. 42nd Street, N. Y. C.
56. Motor Vehicle Dept. of Wis.	Madison, Wis.
57. National Bd. of Fire Underwriters	Public Relations Bureau 85 John Street, N. Y. C.
58. National Carbon Co.	Cleveland, Ohio
59. National Development Bureau, Canada	Canadian Government Ottowa, Canada
60. National Retailers Mutual Insurance Co.	Film Distribution Dept. 7450 Sheridan Rd., Chicago, Ill.
61. National Safety Council	20 N. Wacker Dr., Chicago, Ill.
62. National Society for Prevention of Blindness	1790 Broadway, N. Y. C.
63. National Tube Co.	Frick Bldg., Pittsburgh, Pa.
64. Norton Co.	Worcester, Mass.
65. Perfect Circle Co.	Hagerstown, Ind.
66. Portland Cement Assn.	33. W. Grand Ave., Chicago, Ill.
67. Pyrene Mfg. Co.	560 Belmont Ave., Newark, N. J.
68. Ray Bell Co.	821 University Ave., St. Paul, Minn.
69. R. C. A. Radiotron Co.	Harrison, N. J.
70. Remington Arms Co.	60 Warren St., N. Y. C.
71. Remington Rand Inc.	465 Washington St., Buffalo, N. Y.
72. Rockwood Sprinkler Co.	48 Harlow St., Worcester, Mass.
73. F. K. Rokett Co.	6050 Sunset Blvd., Hollywood, Cal.

74. Singer Sewing Machine Co.	Educational Dept. 797—8th Ave., N. Y. C.
75. Smith Bros. Mfg. Co.	Carthage, Mo.
76. South Bend Lathe Works	So. Bend, Ind.
77. Southern Bell Telephone Co.	Atlanta, Georgia
78. Southern Cypress Mfg. Assn.	722 Barnet Nat'l. Bank Bldg. Jacksonville, Fla.
79. H. F. Staples Co.	Medford, Mass.
80. Sun Oil Co.	1608 Walnut St., Phila., Pa.
81. Superheater Co.	60 E. 42nd St., N. Y. C.
82. Thermoid Rubber Co.	Trenton, N. J.
83. Traveler's Insurance Co.	48 Harlow St., Worcester, Mass.
84. U. S. Steel Corp.	71 Broadway, N. Y. C.
85. United Wallpaper Factories, Inc.	3330 W. Fillmore St., Chicago, Ill.
86. Van Camp Sea Food Co.	Terminal Island, Cal.
87. Western Electric Co.	120 W. 41st Street, N. Y. C.
88. Westinghouse Electric Co.	E. Pittsburgh, Pa.

CHAPTER XIV

Administration of Visual Aids Program

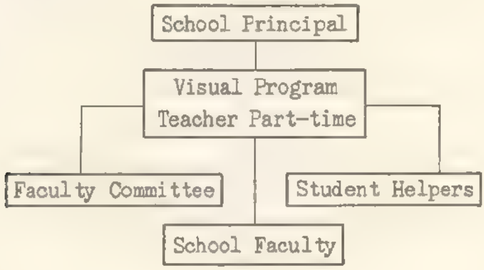
If a visual program is to function efficiently, it must be properly organized and managed regardless of its size. These programs are usually on one of three levels: (1) the individual school, (2) the medium-sized city, and (3) the metropolitan center. There are common denominators among the three situations as indicated in the following discussion. The important factors in every case are sufficient funds, proper equipment, adequate space, and competent management. Unless these things are provided, no program can be launched or maintained. Enthusiasm cannot be substituted for material assistance and official support. It requires all of the factors enumerated above for long-range success.

The programs of the armed services for the creation and use of training aids produced very tangible results, and consequently civilian educators should give full consideration to these tested techniques for adoption. It is true that the war program was not restricted by lack of funds or academic debate, which, no doubt, accounted for its accomplishments. A specific job was to be done and full attention was focused on the objective. The results achieved were far beyond anticipations of the most enthusiastic leaders. The fact that schools do not have all the advantages of the armed forces is no excuse for not doing the relatively smaller job with the facilities at hand. It is logical to suggest that state departments of education, large and small cities, as well as individual vocational schools and teacher training institutions should plan a visual aids program commensurate with their responsibilities and curriculum demands.

In the individual school the visual aids program may be restricted to a small room under the supervision of a capable and enthusiastic

teacher. He should be compensated for this special service in terms of time or money.

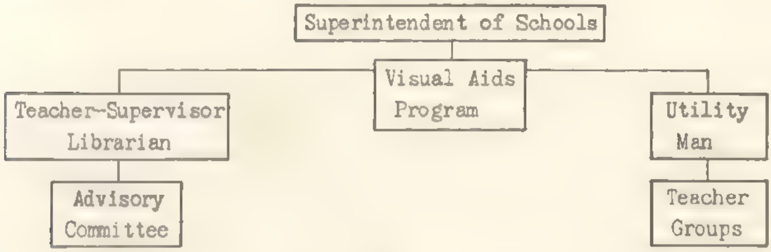
The medium-sized city will require at least two large rooms to satisfy the needs of the program. It will be necessary, then, to have a full-time person for the routine work; the part-time general



14-1

supervision and administration may be delegated to a person of appropriate abilities. This person may be a teacher or librarian who has interest in or training for the job.

A large city of 100,000 or over will require considerable space and personnel to handle the diversity and amount of work involved (Figure 14-3).



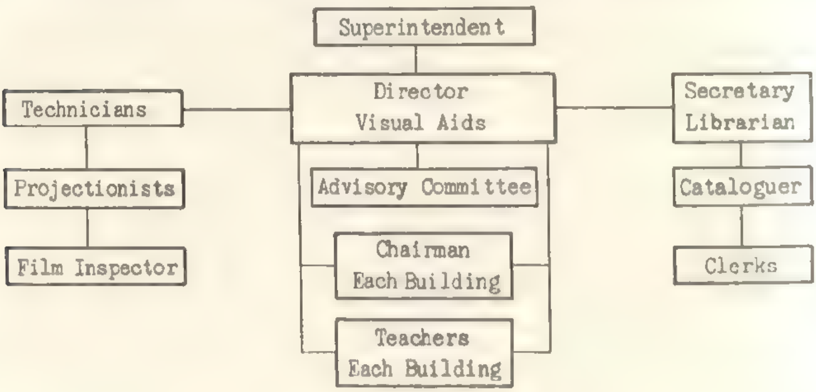
14-2

The problems of organization and administration of a visual aids program are very much the same, whether they are those of a single school or a city system. These problems differ only in magnitude, not in kind. Matters of the budget, space, equipment, and personnel will be relatively large or small according to whether the visual aids program is set up in a school, a depository, or a department in a small city or whether it is a center or division of a metropolitan

school system. The various aspects of such a program will be discussed with the hope that the reader will make the adjustments and adaptations necessary for his individual situation.

Budget

The allocation of adequate funds is basic to any visual aids program—large or small. It has been demonstrated by the military authorities, and sufficient proof exists in civilian education, that visual instruction is most effective and is here to stay. Consequently, alert educators will provide in their budgets ear-marked amounts for



14-3

the purchase and maintenance of equipment as well as sufficient personnel to operate a worth-while program. There is no doubt about enthusiastic public support if the school authorities will inform the public adequately concerning the instructional possibilities of this type of program.

It is difficult to estimate the amount of funds needed, and therefore the request for an initial appropriation may have to be based on opinions and approximations. The conditions differ from one situation to another, and therefore a certain amount of trial and error is unavoidable and should be accepted. It is probable that fifty cents per pupil is a reasonable basis for estimating the amount of money needed to launch a city school system program. The experience of the first year will dictate the amount to request the succeeding year. Unless sufficient funds are provided for continued operation, maintenance, and replacement, the program will disintegrate and will be

discarded. The amount of funds allocated for this purpose varies considerably. Furthermore, the figures available do not indicate whether or not salaries were included, in which case comparisons are not valid. One large eastern city was noted for having spent \$0.07 per pupil while another city in the same state spent \$0.85 per pupil. In one mid-west city, \$1.17 was spent, while in another mid-west metropolis \$0.42 per pupil was expended.

In a project of this type there are three aspects of the program that must be considered when establishing a budget.

A. The initial purchases and installation.
B. The expense of normal operation.
C. The funds for expansion and growth in the way of materials and equipment.

A. Initial Purchases and Installation

1. Projectors and Special Devices

   This list would consist of motion picture projectors, slide and slide-film projectors, opaque projectors, models, charts, screens and loud speakers.

2. Accessories

   Projector stands, film splicer, rewinds, extra reels, film storage cabinets, inspection table, filing cases, and extension cords.

3. Electrical Connections

   Electrical outlets placed at convenient locations if not already provided.

4. Acoustical and Light Treatment

   In special cases it may be necessary to install draperies or other material for sound motion pictures for proper reception. Invariably provision must be made for darkening classrooms or the special projection room. Various arrangements of shades and drapes are essential for good projection. The initial cost may be high in many cases, but the upkeep is almost negligible.

B. Normal Operation

After the program is in operation, funds are required for repair and replacement of film, transportation charges, film rental, and

other incidentals such as cleaner, film cement, and inspection gloves.

In addition to expense for materials, salaries must be considered. The amount for this purpose will depend on the size of the project and the extent to which employees assigned to other duties are used part-time. The best results, however, are secured with full-time assistants.

Despite the best of care in the operation of equipment, it will need cleaning, oiling, and replacements. It has been found advisable to have a reputable agency give the motion picture projectors an annual inspection unless a local mechanic has the technical skill to make an overhaul. The normal life expectancy of a motion picture machine is about five to seven years, depending on its care and use. Other types of projectors have a longer life because there are no rapidly moving parts and consequently less wear on the machine.

In a large system the distribution cost is considerable if truck service is used. This cost may be reduced by using pupil messenger service.

C. Materials for Growth and Expansion

The developments in the projection field are frequent and numerous; therefore, budgetary allowances should be made for immediate purchase of additional items when necessary. The original installations may have been too conservative and supplementary items are essential. New and more efficient accessories may become available in which case their purchase should be possible without special approval.

It is evident that many things must be considered when making a budget for a project that is so diversified. For example, much of the material is expendable, and consequently provision must be made for its immediate replacement if the visual aids program is to continue in a normal way without lapses of inaction. It is reasonable to believe that every modern school system will consider expenditures for visual aids just as legitimate as the purchase of textbooks in the past.

Purpose of Visual Aids Center

A. To serve as a distributing center for visual materials including films, slides, charts, models, displays, and other instructional materials with special eye appeal.

B. To provide information concerning sources of teaching aids and in that way act as a clearing house for this material.
C. To repair and maintain all equipment used in the schools of the system.
D. To encourage the use of visual material by group meetings and by contact with individual instructors.
E. To recommend for purchase equipment that will be helpful in the effective teaching of specific subjects.
F. To plan for adequate training of teachers in the use of projection equipment.

Management of a Program

A program of this type can function successfully only when the enthusiasm and leadership are provided. The organization, administration, and supervision of the work depend upon the one in charge and naturally he must be a person of diversified abilities. In the single school it may be an interested teacher, in the small city it may be a librarian or an outstanding teacher with a technician as an assistant, in the large school system it should be a full-time director.

A. Regardless of the situation the individual selected should possess the most of the following desirable *qualifications:*
   1. Enthusiasm for the job in addition to qualities of leadership.
   2. Mechanical ability to a reasonable degree.
   3. A comprehensive knowledge of education.
   4. Experience as a teacher.
   5. Interest in curriculum development and improvement in teaching techniques.
   6. Ability as an organizer and administrator.
   7. Personality and appearance that invite respect.
B. The responsibilities delegated to this individual are both administrative and supervisory.

Administrative

1. Preparing a sound budget.
2. Securing teachers' co-operation.
3. Selecting and installing equipment.
4. Collecting and classifying materials.

5. Participating in curriculum revision.
6. Assisting schools in problems of projection.
7. Training assistants.
8. Compiling bibliography and digests.
9. Stimulating producers to provide needed teaching aids.
10. Encouraging and co-ordinating research.
11. Providing information on equipment and materials.
12. Making provision for a workshop where teachers can construct their own teaching aids.
13. Planning production of specific aids for distribution to the school.
14. Co-operating with outside agencies—state, federal, commercial, industrial, and civic.

Supervisory

1. Conducting teacher conferences to stimulate further use of visual teaching aids.
2. Training teachers in the use of projection equipment.
3. Observing teachers in the use of visual aids in order to be able to suggest ways in which they may improve their techniques.
4. Giving demonstration lessons.
5. Evaluating suggestions of teachers in the selection and use of equipment.
6. Supervising the teacher committee in different schools.
7. Stimulating individual teachers to develop and make their own teaching aids.

Publicizing Department

An attractive handbook should be developed and distributed covering the facilities of the department and how they may be utilized. This publication not only should be a source of information but also should carry brief instructions on the use of projection equipment. It could well include the following:

A. Location of visual aids center—including a map and how the center may be reached by rail or bus.
B. Personnel in charge of each activity.
C. How to use the services of the department.

D. Facsimile of forms used for securing service.

E. A list of available teaching aids classified under subject headings.

F. Outside sources of visual aids
   1. Commercial film concerns.
   2. Special distributors.
   3. State and federal departments.
   4. Manufacturers who have films available.
   5. Manufacturers of special models, charts, etc.

G. Practical hints on setting up projection equipment, darkening the room, seating of students, and other information that will improve the use of teaching aids when borrowed.

H. A general pattern for a lesson plan when using projected aids.

A handbook of this type will greatly enhance a visual aids program in a large metropolitan center. Modifications of the above list of suggested topics will serve as a basis for a mimeographed bulletin of information about the program in a small city or individual school.

Location of Visual Aids Center

The depository, library, or teaching aids center should be located centrally, if possible. The location will be controlled by many factors such as transportation, school board offices, and space already under municipal control. Every effort should be made to locate it where it is readily accessible to the majority of teachers. Its use will depend to a large degree on the ease with which teachers may reach it. A place frequented by teachers is the most logical location—a school library, a public library, or a municipal building.

Space and Physical Equipment

The space to be allotted for a city visual aids center depends on the ideas and vision of the administrators as well as upon the size of the school population. If the center is to be nothing but a depository or distribution center, the amount of space and the personnel needed will be relatively small. On the other hand, if it is to be a place where teachers may go for instruction and counsel on visual materials, then considerable planning must be exercised in its organization. Although the following suggestions are given for a large

city project, the small program will be very similar but on a reduced scale. The factors that follow control the planning of adequate space for a properly functioning center.

A. *Controlling Factors*

1. The school population to be served.
2. The anticipated number of films to be handled.
3. The areas for receiving and shipping materials.
4. Equipment to be housed and circulated.
5. Classroom space for teacher training.
6. Facilities for inspection, repair and overhaul.
7. Space for previewing.
8. Workshop for teachers' use in making aids.
9. Facilities for producing duplicate aids to be used in various schools throughout the system.

All the points above must be considered when planning a city organization or one in a large comprehensive secondary school. The difference is quantitative rather than qualitative.

B. *Equipment*

The list suggested below represents the minimum essentials for good housekeeping and reasonable service. A number of the more important items are illustrated and described in Chapter XV, Equipment for Visual Aids Center.

1. Motion picture storage cabinets or racks. These should be standard in design as it is not economical to use some improvised cabinet.
2. Film-strip storage equipment is equally important and requires a form of rack that permits proper storage and indexing for ready reference.
3. Slide cases and cabinets to accommodate both the 2″ x 2″ and 3¼″ x 4″ slides should be included.
4. Film splicer—This is an indispensable tool when film is being used. There are numerous kinds of which the example illustrated is typical.
5. Film rewinder—This is necessary equipment. The number to be purchased depends on the volume of business.

6. Inspection table—This piece of equipment is very useful particularly in a school program. It is necessary to examine all film upon its return to the distribution point.
7. Film shipping cases—These are essential for protecting the reels of film during transportation as well as during the period of shortage.

The above items are specialized for film storage, but in addition various other things must be provided such as filing equipment, desks, chairs, and shelving for storage of parts, and general supplies. There should be a generous amount of shelf space, if good housekeeping is to be expected.

It is not sufficient to have only the equipment listed above available if the training aids center is to function. In addition a supplementary list of supplies is suggested with which the center can meet all the demands that may rightfully be placed upon it.

The needed items are as follows:

1. At least one 16-mm sound projector.
2. Film cleaner (tetrachloride).
3. Film cement.
4. Two slide-film projectors.
5. One 3¼″ x 4″ slide projector.
6. One 2″ x 2″ slide projector.
7. One slide viewer.
8. Two stereoscopes.
9. Two opaque projectors.
10. Two wall projection screens (48″ min. width).
11. One sound slide-film projector and record cabinet.
12. Two kits for making hand-made slides.
13. One film editor.
14. One darkroom with the necessary equipment for developing and printing.
15. One 35-mm camera to be used in 2″ x 2″ slide making.
16. Mimeograph machine.

It will be noted that no equipment for making motion pictures or recordings has been included. These omissions have been intentional because it is questionable whether or not school people should

spend their time making films which will appear amateurish at best when there is so much good professional material available.

Operating Forms

It is most essential that the records of a visual aids project be kept systematically to avoid confusion, delay, and generally unsatisfactory service. There are certain record forms that are necessary while others may be desirable. The forms suggested here are in the first category and would be used for such projected aids as slides,

Accession Record

Slide Films—Machine Shop

No.	Title	Producer	Type	Time	Color	Cost	Date Pub.
MS 21	Machinist, The	JH	Sl	—	B & W		5/1/'47
MS 22	Machine Tools	JH	Sl	—	B & W		5/1/'41
MS 23	Abrasive Wheels	AM	Sl	—	B & W		6/25/'47

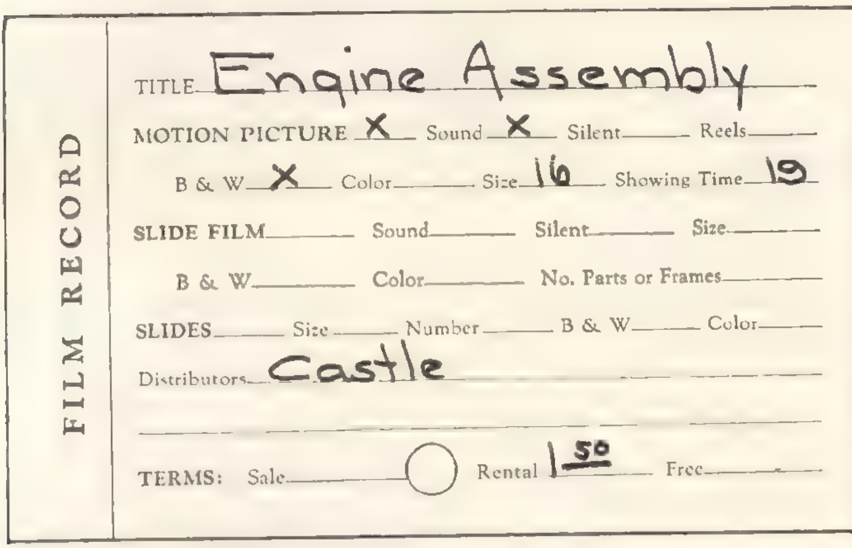
14-4

motion picture films, and film slides. Other aids such as flat pictures, charts, mock-ups, models, displays, etc., will require records similar to these.

Accession Record. The inventory record of a visual aids project should be comparable to the library record of books on hand, and therefore we shall call this first one the accession record (Figure 14-4). A loose leaf accession book should be organized and divided according to the different classification of aids received. A letter code for designating the kinds of aids should be used. For example, M—motion picture, F—slide film, Sd—sound, Si—silent, S—slides, B & W—black and white, C—colored, and R—recordings. The accession number and title of aid should be placed on adhesive tape

and attached to the film can or placed in some suitable spot on models, mock-ups, etc.

Catalogue Record. After the accession record is completed, a catalogue card should be made which includes sufficient information for teachers to make intelligent choices from it. Figure 14-5 shows a card (3 x 5) of that type that may be used in a library card catalogue drawer. It is advantageous to use a variety of colored cards to designate the different types of aids. This arrangement permits immediate identification in the card file. An explanation of the card


FILM RECORD

TITLE Engine Assembly

MOTION PICTURE X Sound X Silent ____ Reels ____

B & W X Color ____ Size 16 Showing Time 19

SLIDE FILM ____ Sound ____ Silent ____ Size ____

B & W ____ Color ____ No. Parts or Frames ____

SLIDES ____ Size ____ Number ____ B & W ____ Color ____

Distributors Castle

TERMS: Sale ____ Rental 1.50 Free ____

14-5

is unnecessary as it carries no abbreviations or symbols not clearly understood.

Glass slides present special problems because they are used in sets or units. In this case it is necessary to designate in the accession book (a) number of slide set or unit S-4, S-5, etc., (b) the title of set, (c) source, (d) number of slides S-4 (16), (e) cost of slides, and (f) date of accession.

The recordings for sound slide films should be listed about as follows: Code letter R1, number of records in series R1 (3), size of record, price, and date. The record should be marked with the code number and also carry the symbol of the slide film to be used with it, for example: R1 (3)—F 20 Sd. In this case it would mean

record number 1, three in series, to be used with slide film F 20 sound.

Cataloguing Teaching Aids. The most convenient form of indexing aids for teachers' use is according to subject matter. It may be found necessary to have a supplementary alphabetical listing, but the need is doubtful. The natural approach to sources of such information is by subjects. A teacher usually will seek aid in teaching a particular course or a specific topic within the course. The subject of internal combustion engines may be used as an example.

1. Internal combustion engine
   a. Automotive
   b. Aircraft
   c. Diesel

Under each of these subheadings would be found the motion pictures, slide films, and slides that are available under each of these main headings. Because different-colored cards are used to designate each form of aid, it is very easy to locate the one desired. A catalogue should be issued with the same format and sent to every teacher in the system. This procedure will remove all excuses for failure to use the available materials. There are times when the film title does not imply clearly its content. For example, "Flying Wheels." In this case, the film refers to the wear and care of automobile tires. An explanation of its contents should appear on either the back or the face of the index card, if space will permit. The same kind of catalogue may be used in a single school.

Forms for Controlling Distribution

Suitable forms must be used to insure the smooth operation of a visual aids program. Two types of forms are required—those used by the teacher to secure the desired materials and those used by the visual aids center to control the distribution.

To show how these forms would be used let us assume that Mr. Wilson, teacher of automotive practice, requests certain films for his use. He refers to the catalogue and finds three films that he desires on spark plugs. He, therefore, prepares his request on the form shown in Figure 14-6.

This form may be used by a single school or by a centralized system in a large city. These forms could be "padded" and issued

to all teachers who will use this service. If the films are not available in the school but must be secured from the teaching aids center, another form is necessary (Figure 14-7). This record is called the "Material Reservation Blank" and is to be used by the school representative when placing the combined requests of several teachers.

Another form indispensable in the control of the aids in the center is a "Booking Card." A single card is necessary for all items

Date 2/20/47 No. 20

REQUEST FOR TEACHING MATERIALS

Requested by Mr. Wilson Room No.________

Type	No.	Title	Date Wanted	Confirmed
M	16	Story of Spark Plugs (2 reels)	3/1—3	
M	20	Ignition and Spark Plugs	3/4—7	
S	42	Good Engine Performance	3/8—11	

Directions: Submit original to visual aids representative who will return it to confirm bookings. Be sure to use code symbols in column TYPE M—Motion picture, F—slide, S—slides.

14-6

available for distribution. This record is the crux of the control system. When requests are received, the booking card is consulted to determine whether or not the requested aids are available. The dots in the spaces to the right of each month indicate the Saturdays, Sundays, and days in the month with less than 31 days (Figure 14-8).

It will be noted that the film on "Dangerous Dusts" was requested for April 21 to 25 inclusive.[1] The booking card indicates that it is available at that time. This film has been requested for the period April 8 to 14 as indicated by the arrows. The number in the circle

[1] See Figure 14-7 (Materials Reservation Blank).

designates the code number of the school that made the request. When the Materials Reservation Card is returned to the school representative, it will look like Figure 14-7.

The above form should be prepared in triplicate—one copy to be retained by the school making the request and the other two

TEACHING AIDS CENTER

MATERIALS RESERVATION BLANK

Date April 1, 1947 Code No. 15

This requisition should arrive a minimum of ten days before the date on which the material is needed. Service on shorter notice is sometimes possible.

Ship to:
Progressive School
126 No. Prospect St.
Bronx
c/o R. U. Prompton

Kind	Title	Prod.	Type	Color	Incl. Date Desired	Dates Confirmed Do Not Fill In
M	Dangerous Dust	NPC	Sd	B & W	4/21—25	OK
M	Death Never Takes a Holiday	SC	Sd	B & W	4/15—18	BD
S	Iron & Steel	UK	—	B & W	5/5—8	OK
F	Flight Instruments	JH	Si	B & W	4/21—25	OK
F	Copper Nerves	ASC	Sd	B & W	5/12—15	DM

Important: Give complete information to avoid delays and mistakes

Ordered by: R. U. Prompton

School: Progressive No. 24

Shipping Address 126 No. Prospect St.

Confirmation Notes

This form, when returned, will indicate the answer to your request.

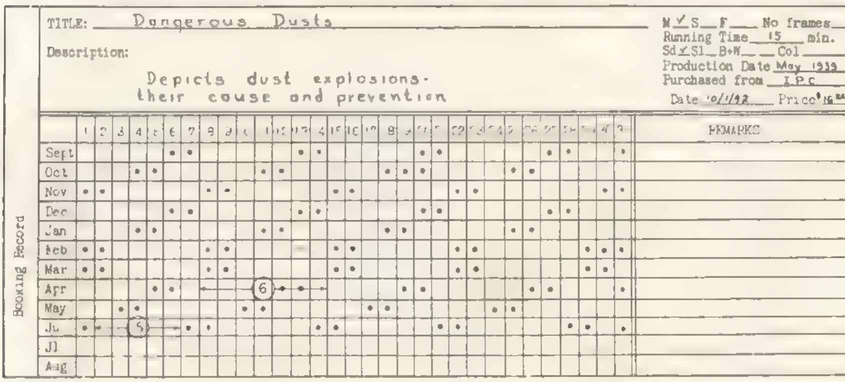
BD— Booked to another school
NA— Not available from Teaching Aids Center
WD—Withdrawn from circulation
DM—Damaged—temporarily out of circulation
RE— Re-order at later date

14-7

copies should be sent to the teaching aids center. One of these copies will be returned with the confirmation of the date indicated in order that the representative may inform the individual teachers about their requests.

Shipping Labels

It is advisable for the distribution center to prepare the shipping labels "going" and "coming" in order to reduce errors to a minimum.

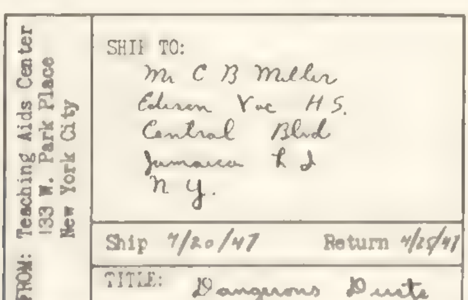


14-8

These may be written at the time the request is received and filed in a shipping file under the proper date. A satisfactory two-way shipping label is shown in Figure 14-9.

Borrowed Equipment

There may be communities in which the projection equipment can be borrowed from the visual aids center, but such a situation



14-9

will not last long. It will be discovered at an early date that the loan of equipment from a centralized point is inadvisable for two reasons: (1) the cost and inconvenience of delivery and collection, and (2) the difficulty of satisfying the demands. It is a far better arrangement to have the projectors in the respective schools. The time and difficulty involved in securing the service from the teaching aids center will defeat the whole program. Teachers will not use the equipment if it is difficult to obtain when wanted.

Maintenance

The projection equipment requires delicate adjustments and should be serviced at the center, rather than in the respective schools. It will prove more satisfactory to have the machines sent to the center for service than to permit inexperienced people to tamper with them. One capable technician can keep numerous machines in repair and also can instruct teachers in the care and use of the equipment.

There should be available at the center an adequate reserve supply of spare parts such as: projection lamps, pilot light bulbs, exciter lamps, amplifier tubes, fuses, spring belts, extension cords, and receptacle plugs. It should be possible to requisition these items when needed and receive prompt delivery.

Suggested Equipment

There can be no arbitrary estimates of the needed equipment, but it is possible to suggest purchases that are approximately in harmony with the needs, if there exists a functioning program under enthusiastic leadership. The suggestions offered are exclusive of the equipment for an auditorium. We are concerned primarily with visual aids in the classroom rather than "school movies" in the school auditorium. In this latter situation specialists must be consulted in order that the projector illumination and amplification are sufficient for the architectural features of the specific room. Unless there is great need for the auditorium "movies," it is wiser to invest the money in a classroom program.

A sound film projector can be justified for a school of 100 students and additional projectors for each additional unit of 200 students. Because of the definite trend in the direction of sound films, it is inadvisable to purchase a silent machine.

Every school of 50 students should have at least one *slide-film projector.* If only one is purchased, it should be a combination slide film and 2″ x 2″ slide model. When a second purchase is made, it should be a portable sound slide-film projector. A large number of slide films are being produced with a record carrying the script. The future promises many more, and the school should be equipped to benefit from developments in this line. Every additional registration of 200 students warrants the purchase of an additional slide film projector.

A *projector for showing 3¼″ x 4″ slides* is a necessary adjunct to a visual aids program. The aggressive teacher will produce many home-made slides for his particular subject and naturally needs a projector for his use. Additional purchases of this type of projector will depend on the demands of the teaching staff.

An *opaque projector* is another essential teaching tool and no school should be without one. The number required will depend on how progressive the teachers are in the use of modern techniques of teaching.

Screens for satisfactory projection should be provided. Although the standard matte or beaded screens are desirable they are not a "must." It is possible to secure satisfactory results in the average school room by the use of ordinary white window shades.

There are no specific criteria to use in the purchase of projection equipment because of the varied objectives that may be set for the program. The suggestions made above are very modest but adequate to start a visual aids program. Additional purchases should be predicated on (1) the enthusiasm of teachers, (2) the availability of good visual materials, (3) the financial ability to maintain the equipment, and (4) the evidence of more effective learning through visual instruction.

Rental vs Purchase of Films

There are many useful films available in commercial organizations which may be secured for only the cost of transportation. Other films specifically designed for teaching school subjects may be rented or purchased from film producers. The rental cost may range from $1.00 to $3.00 per reel per day of use. If the film is used very many times, it may be economical to purchase rather than to rent it. A little simple arithmetic will supply the answer to the question of

purchase vs rental. In addition to the economy of cost, there is an added advantage of availability. The teachers will be more enthusiastic about the use of the films if they can secure them locally without delay. In general teachers will use visual aids inversely to the amount of trouble involved in using the facilities.

At the conclusion of various chapters will be found lists of film distributors and individual manufacturers and organizations which have films for loan or sale. In practically all cases, catalogues or descriptive leaflets will be forwarded upon request.

Conclusion

The preceding material revolves around the use of films because they lend themselves to centralized control and distribution. There are a great many other teaching aids such as charts, posters, models and exhibits that are in daily use but it is not probable that they will be deposited in a central location and issued on requisitions. They are more likely to be retained by the individual teacher because they are usually the property of the individual teachers. However, it is possible that several teachers of the same subject will have use for the same aid, in which case it could be filed in a central location and issued upon request. In the final analysis the extent to which visual teaching materials are used is dependent on the enthusiasm, direction, and supervision of the visual aids director, the school principals, and subject supervisors. Teachers will follow dynamic leadership if its objective is professional improvement.

It is safe to predict that:

1. There will be public financial support and a strong demand for audio-visual education.
2. Audio-visual specialists will be trained to provide the needed leadership.
3. Pre-service and in-service courses for teachers will be available in all teacher training institutions.
4. Better and more efficient visual equipment will be developed by manufacturers as a result of keen competition.
5. Out of school agencies, such as women's clubs, boy and girl scouts, organizations, and community groups will make extensive use of visual materials.

6. Large and small cities will establish teaching aids centers staffed by professionally trained personnel.
7. Graduate schools will develop research projects to encourage more efficient techniques of seeing and hearing.
8. Classrooms and auditoriums will be designed to provide better facilities for the use of audio-visual teaching devices.

Public Film Library

The time is fast approaching when films on a great variety of subjects will be available through a majority of local public libraries. The lay public is aware of the educational value of motion pictures and consequently influence will be used to allocate funds from the library budget for the purchase and rental of films.

It is just as simple for a librarian to issue films as it is books. The storage problem is no greater than it is with books, but a different set of rules for issuing films must be established.

Suggested List of Rules for Film Lending Library

Regulations covering the lending of films will vary according to the community. There are always local factors that must be taken into consideration with such a project. The following rules are suggested as a general guide.

1. Users of film must hold a public library borrower's card.
2. The library takes no responsibility for projection. A 16-mm sound projector and a competent operator must be provided by the borrower.
3. Films may be picked up after 1 P.M. on the day they are booked and must be returned before 1 P.M. the following day.
4. Borrowers are subject to a fine of 25¢ a day on each film not returned before noon.
5. Films are due, unless otherwise specified, on the morning after the showing. The time may be extended for schools and churches.
6. Films should be booked as far in advance as possible.
7. Film reports must be made on use of all films.
8. Borrowers of films for home showings must have 15 persons for a single showing. Home programs are limited to one program a week.

9. Number of films are limited to a 1½-hour program. Not more than two cartoons may be issued to a borrower.
10. All films are inspected before lending, and they are expected to be returned in good condition. The borrower will be held responsible for any damage, and will be expected to pay the cost of repair or replacement beyond ordinary wear and tear.

References

1. Bell, Walter S., "Atlanta Audio Visual Anniversary," *Educational Screen*, November 1947, p. 494.
2. Dale, Edgar; Dunn, Fannie W.; Hoban, Charles F., Jr.; Schneider, Etta, *Source Book for Teachers and Administrators*, New York, H. W. Wilson Company, 1937.
3. Educational Film Library Association, *Making Films Work for Your Community*, Committee of Community Use of Films, New York, 1946.
4. English, Mildred and Stratemeyer, Florence B., "Selection and Organization of Materials of Instruction," *Materials of Instruction, English Yearbook*, N.E.A. Department of Supervisors and Directors of Instruction, Teachers College, Columbia University, 1935, pp. 129-148.
5. *How to Run a Film Library*, published by Encyclopaedia Britannica Films, Inc., Chicago, Illinois.
6. "Iowa State Audio-Visual Laboratory," *Educational Screen*, November 1947, p. 492.
7. Reed, Paul C., "Visual and Auditory Aids to Enrichment," *Eighteenth Yearbook*, Department of Elementary School Principals, 1839, pp. 414-419.
8. Wilson, D. C., *How to Organize a Film Library*, National Film Society of Canada, 172 Wellington St., Ottawa, Canada.

CHAPTER XV

Equipment for Visual Aids Center

Motion Picture Machine

A wise selection of visual aid equipment is possible only when the teaching situation is considered in which the equipment is to be used. For example, there is no "best" projection machine. It is not probable that any one machine will possess all the best features of machines of its class such as low cost, ease of operation, film protection, dependability, flexibility, portability, and other minor factors. However, the school machine should be one that accommodates 16-mm slow-burning acetate film. The 35-mm machine should be left exclusively for commercial theater use.

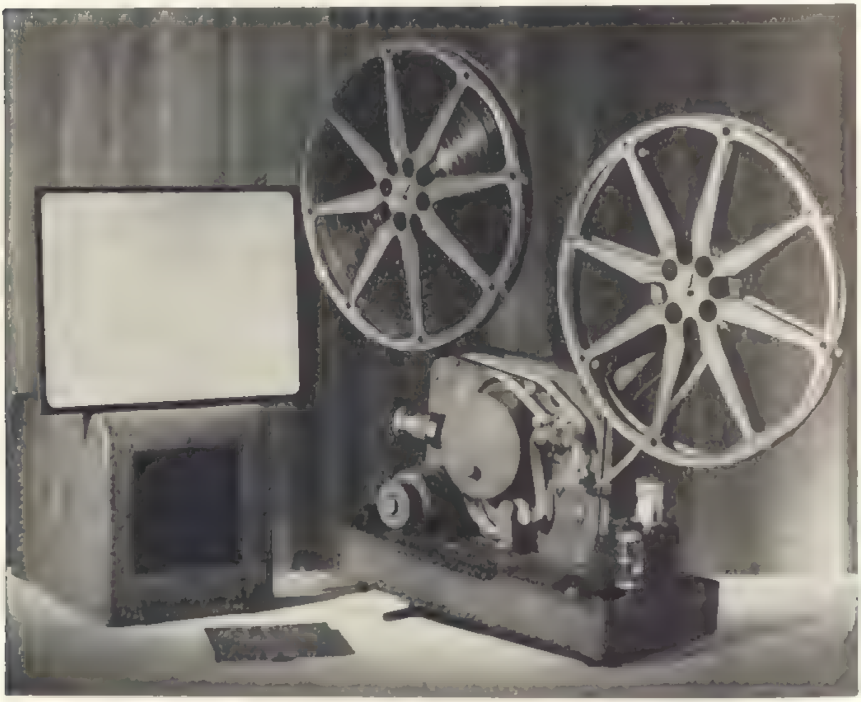
A detailed consideration of these features will help in the selection of an ideal motion picture machine.

1. *Ease of operation and film protection.* These characteristics should supplement each other. If the light, power, and sound controls are close together and clearly labeled, the threading easily done, the rewinding adjustments simple to make, the picture steady, the machine may be said to fulfill the first requisite.

2. *Performance and flexibility.* The machine should be noiseless and operate without flicker. In some cases the place in which the machine is used will control the selection. The machine constructed for the classroom will not give complete satisfaction in an auditorium. The contrary is true that the auditorium machine may be used in the classroom. The machine must necessarily carry a high power bulb (750 to 1000 watts) and an amplifier of sufficient volume with effective tone control. Fidelity is a most important factor as the public is accustomed to the high fidelity of FM radio and recordings. If funds are available, it is wise to buy a machine for the auditorium and another machine for the classroom. It is highly questionable whether or not any consideration should be given to a silent projector because of the ever-increasing trend to produce sound films. The

sound machine is more flexible because silent films may be used with it, but the sound films may not be used on a silent machine.

3. *Portability.* This is a most important factor when the machine is to be used in a variety of locations. But if the machine is permanently located in an assembly room, the weight is unimportant. There was a very definite need for a portable classroom projector,

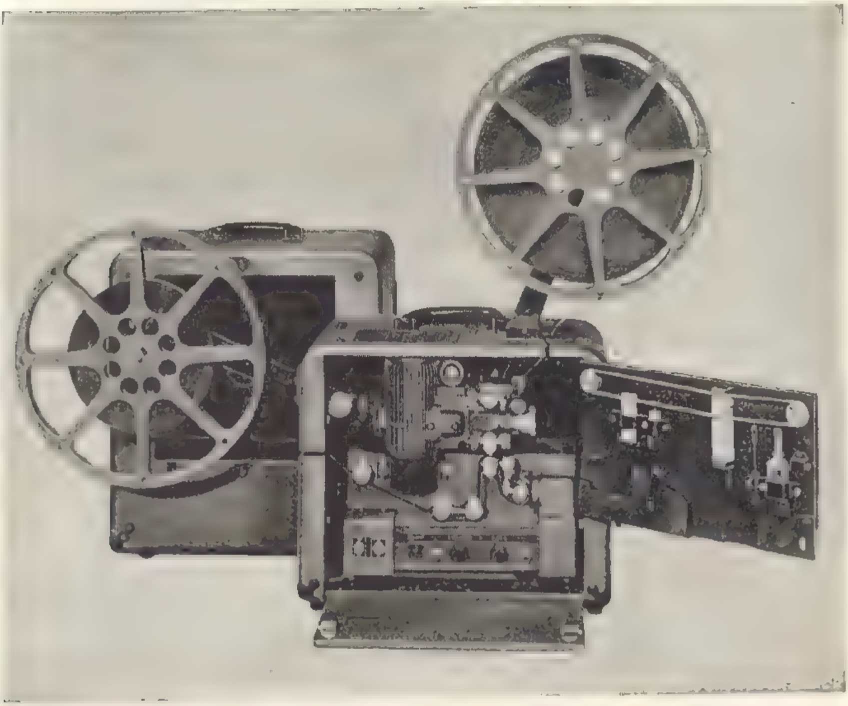


15-1. Movie-Mite 16-mm sound projector. (*Courtesy Movie-Mite Corporation.*)

and during 1947 several portable machines appeared on the market and were enthusiastically received. A weight of less than 30 pounds is convenient to handle and reduces the probability of damage to the parts when moved from one location to another.

4. *Dependability and maintenance.* Probably the best criterion for judging these two mechanical features of a machine is the experience of someone who has used it. If a person is not mechanically inclined, he should solicit assistance when purchasing the equipment. In evaluating the machine for dependability and maintenance the following should be considered: the construction, smooth running

of operating parts, the lubrication points, the cooling system, safety tips, and film guides that minimize the possibilities of film damage. Other important items to look for are: the accessibility of the film track, the number of film bends and twists, quick replacement of exciter and projection lamps, rapid rewind mechanism, and access to amplifier, tubes, and fuses.



15-2. 16-mm sound projector. (*Courtesy Bell & Howell Co.*)

Finally a purchaser should investigate the possibility of prompt local service and the availability of service parts. It is the height of folly to purchase a machine of unknown make from a company without local service representatives. In this case a low initial cost may result in much expense and inconvenience. It will be found, upon examination, that, although practically all motion picture machines possess the same features, certain parts of some machines are greatly improved over those same parts in other machines. In the finality the best selection is the machine that includes the greatest number

of important features requiring a minimum of maintenance at the lowest initial cost (see Figures 15-1 and 15-2).

Slide and Film Projectors

Slide Projectors 3¼″ x 4″

There are available a number of very satisfactory projectors for the projection of 3¼″ x 4″ slides. The single-purpose model shown in Figure 15-3 is very efficient. During recent years combination projectors have been placed on the market which accommodate both 3¼″ x 4″ slides as well as the 2″ x 2″ size. There are also combina-

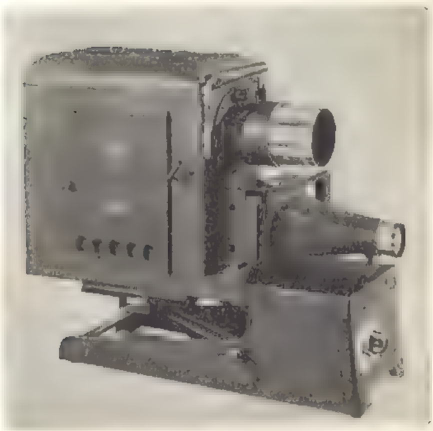
15-3. 3¼″ x 4″ single-purpose slide projector. (*Courtesy American Optical Co.*)

tions of the opaque projector and the 3¼″ x 4″ slide attachment. The single-purpose machine is to be preferred if the visual aids fund will allow for the purchase of several projectors for the various purposes. In all cases, the single-purpose machine is less complicated, easier to operate, and it has no attachments to be lost or broken.

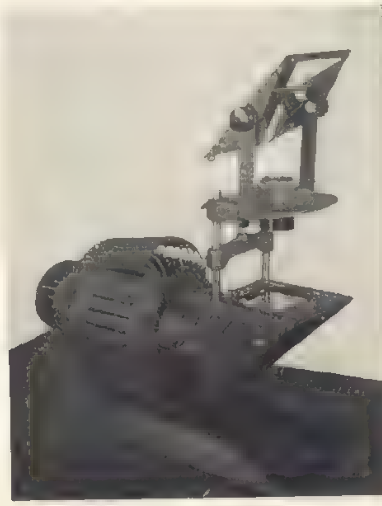
If funds are limited, a dual-purpose machine may have to be purchased. There are a number of models from which to make a choice. Figure 15-4 shows a very convenient projector for 3¼″ x 4″ slides combined with an opaque projector.

The machine shown in Figure 15-5 deserves special mention because of its specific advantage for teachers. In this projector the glass slide is placed on the table of the machine and reflected through a lens into the mirror and then projected to the screen. This ar-

rangement enables the instructor or lecturer while facing the students to point out certain features of the picture by using a pencil or small pointer on the slide. In turn the pointer is shown in sil-



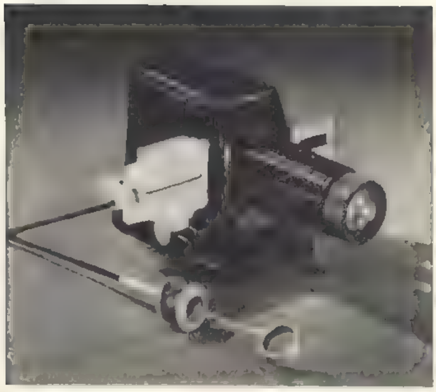
15-4. Combination machine—opaque projector with slide attachment. (*Courtesy Bausch & Lomb Optical Co.*)



15-5. Overhead projector for slides and other transparencies. (*Courtesy Keystone View Co.*)

15-6. 2″ x 2″ single-purpose slide projector with holder for one slide. (*Courtesy Society for Visual Education.*)

15-7. 2″ x 2″ single-purpose slide projector with holder for two slides. (*Courtesy Ampro Corporation.*)



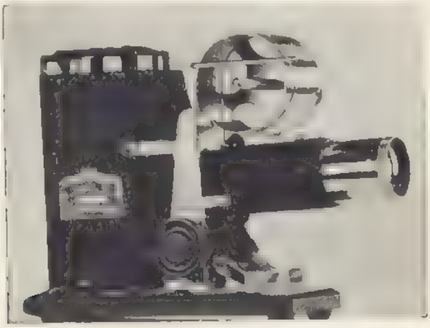
15-8. 2" x 2" slide projector with magazine and remote control device for changing slides. (*Courtesy Eastman Kodak Co.*)

15-8a. 2" x 2" slide projector with magazine feed and electric remote control (*Courtesy Picture Recording Co.*)

houette on the reflected picture. The instructor in this case is his own projectionist and at the same time has complete control of the class. This same machine may be used for the projection of 2″ x 2″ slides by the use of a simple inexpensive attachment that may be purchased with the machine.

Slide Projectors 2″ x 2″

Projectors for the 2″ x 2″ slides only are small and convenient for transportation (Figure 15-6). A very satisfactory type is one with a slide carrier that holds two slides at a time (Figure 15-7). While one slide is being projected, the spring in the carrier ejects the other slide to the rear in such a way that it can be removed by the operator



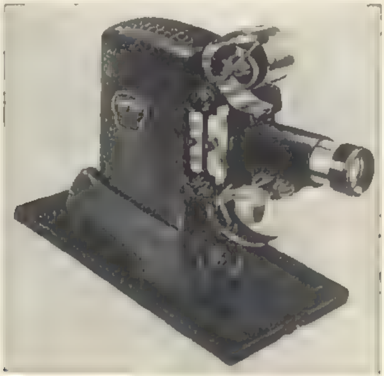
15-9. Single-purpose slide film projector. (*Courtesy Society for Visual Education.*)

and another placed in position ready for showing. This arrangement allows a continuous showing controlled from one position and avoids the necessity of reaching over the machine to remove the alternate slides. It also eliminates the rather annoying break between the showing of successive slides which has been the case with old-style projectors.

There are attachments available for use with the 2″ x 2″ projector operated by remote control that feed the slides from a magazine. The series of slides is placed in the magazine according to the desired sequence, after which they are brought into the projection position at the will of the instructor by the control mechanism. This is a most efficient device and results in a smooth, uninterrupted presentation always under the control of the teacher or lecturer. Figures 15-8 and 15-8a are examples of this model machine. The projector

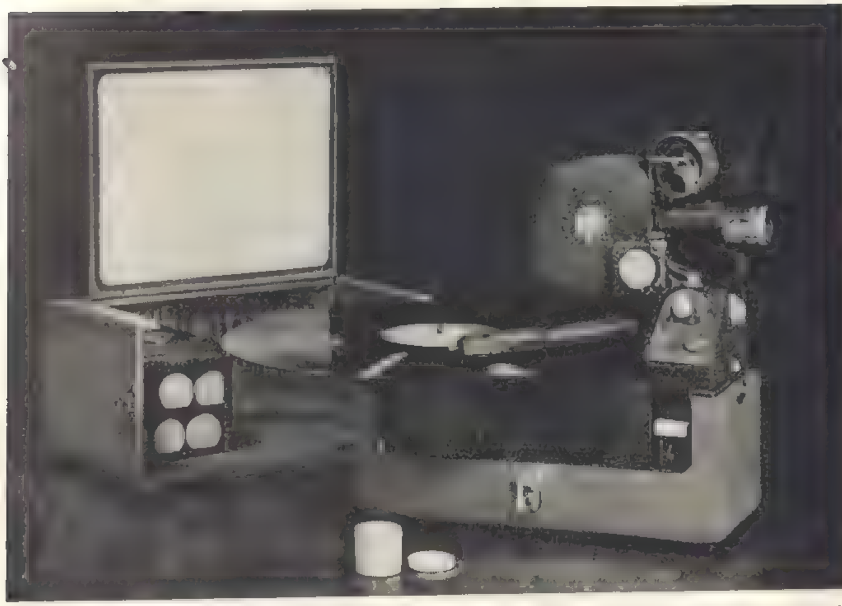
shown in Figure 15-9 is for slide film only. It is an inexpensive unit and is very efficient for ordinary classroom use.

Figures 15-10, 15-10a show projectors that accommodate 2″ x 2″

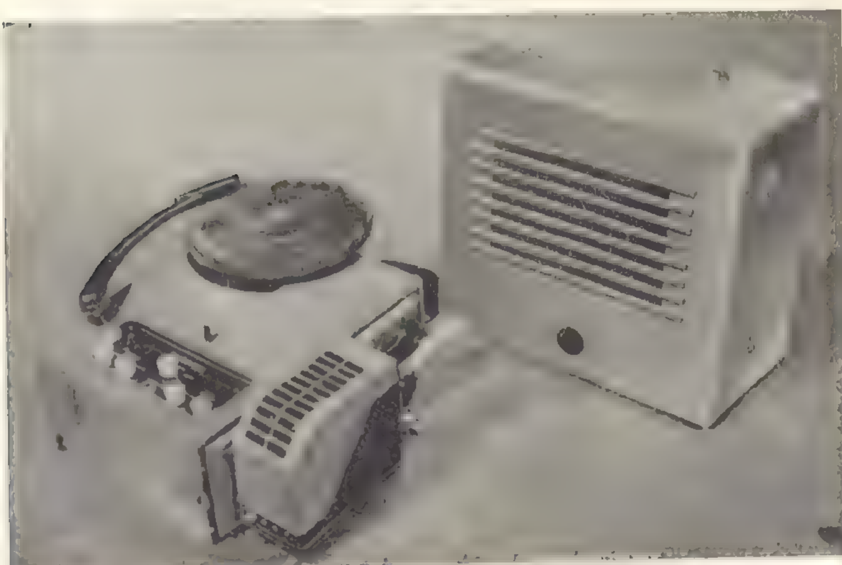


15-10. Dual-purpose slide and slide film projector. (*Courtesy Ampro Corporation.*)

15-10a. Dual-purpose slide and slide film projector. (*Courtesy Society for Visual Education.*)



15-11. "Explainette"—sound slide film projector. (*Courtesy Operadio Mfg. Co.*)

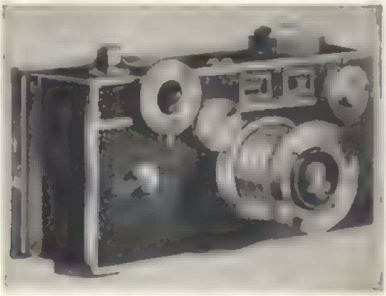


15-11a. "Viewlex" or soundview projector with automatic electric view changer. (*Courtesy Automatic Projection Crop.*)

slides and slide film (single and double frame). Naturally these have advantages over the single-purpose units and are to be recommended. Figures 15-11, 11a, 11b, show sound slide-film projectors with 16-inch records which are becoming more and more popular because of the increasing use of sound with slide film. The first two, Illustravox and Explainette respectively, are manually operated while the last one, called the Soundview, is electrically controlled.

15-11b. "Illustravox"—a compact sound slide film projector. (*Courtesy Magnavox Co.*)

Once the initial setting of the latter machine is made, the operator need not touch it. A supersonic signal which is not audible to the human ear causes the film to index automatically to the next frame. It is necessary to use the records especially made for this particular machine. The records used on the other two machines illustrated may be used on the Soundview if the frame changer is operated manually. This machine has considerable merit and promises to be widely used when a variety of special films and records are available;



15-12. "Argus" camera suitable for making 2" x 2" slides

however, any silent slide film may be used on it. This machine will project 2″ x 2″ slides as well as 35-mm slide film.

The Leica, Eastman 35, Contax, and Argus camera (Figure 15-12) all use 35-mm film which is the correct size for producing 2″ x 2″ slides. This film may be bought in black and white or color, in cartridges, which is sufficient to make 18 or 36 double-frame exposures. It is also available in bulk, in which case the desired length is cut off. This is less expensive, but less convenient because of the necessity of "loading" the cartridge in a dark room. The negative can be processed and positive film made by the amateur or by a commercial laboratory at a nominal cost.

Slide Projectors 2¼″ x 2¼″

Increasing attention should be given to the growing popularity of the 2¼″ x 2¼″ transparency and its use as a 2¾″ x 2¾″ slide. This popular picture size is more than 3 times larger in area than the usual 35-mm slide, producing a correspondingly sharper and brighter projection with the same lamp.

Projectors are available for the 2¾″ x 2¾″ slide which also handles the older 2″ x 2″ transparencies. The decided trend toward cameras which take a 2¼″ x 2¼″ picture and the availability of color film for this popular size makes consideration of this type projector important. At least one manufacturer is producing this type of projector, which will also handle the 35-mm slide film as well as a variety of slide sizes.[1]

Overhead Projectors

This type of projector (Figures 15-13, 15-13a) has a lot of merit and will prove to be a very valuable accessory to a program of visual education. A powerful light in the body of the machine passes through the transparent glass as well as through the slide or other transparency being used. The image appears in the mirror above the machine and in turn is reflected on the screen back of the instructor. One trade name for this machine is the VisualCast and another the Vu-Graph.

The instructor may prepare his drawings or other transparencies before the class session, or he may make the required sketches on

[1] Viewlex, Inc., 35-01 Queens Boulevard, L. I., New York.

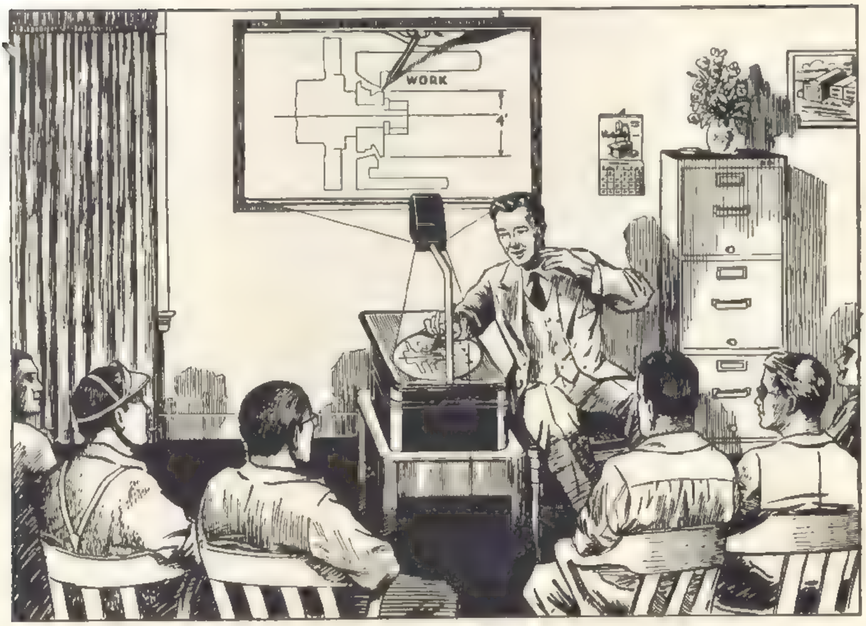
the transparent sheet of material, provided with the machine, during the presentation of the work. The outstanding feature of the machine is the student-teacher relationship that it makes possible. A teacher can face his class and be able to write, draw, or point to details as he develops the lesson.

It is possible to project slides of all kinds with this machine as well as transparencies made by the teacher at a nominal cost. The task of drawing on the blackboard and then erasing the drawings is eliminated. The transparencies may be preserved in a very small space for further use. In lieu of an expensive projection screen an ordinary, white window shade may be used. It is feasible to build a machine of this type in a school shop.

15-13. "Visualcast" and overhead projector used with transparencies. *(Courtesy Victorlite Industries.)*

Types of Opaque Projectors

The opaque projector is such an excellent accessory that every classroom and shop should be equipped with one. There are various types available ranging from simple inexpensive ones to those which are multiple purpose machines at higher cost.

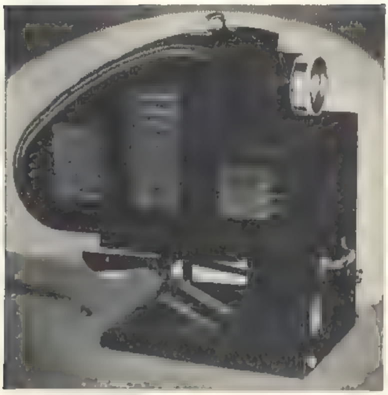


15-13a. A sketch showing the manner in which the overhead projector is used. (*Courtesy Victorlite Industries.*)

The unit shown in Figure 15-14 is very satisfactory for use in the average classroom. It may be classified as a simple purpose device because its use is confined to the projection of opaque pictures and objects. The trade name for this machine is Pictograph.[1]

15-14. Pictograph—a simple, efficient, opaque projector for classroom use. (*Courtesy Keystone Co.*)

[1] Keystone Manufacturing Company, Boston, Mass.



15-15. Opaque projector for maximum copy 8½" x 11". (*Courtesy Bessler Company.*)

It is inexpensive, has a limited number of parts, is very light and is consequently portable. Its most efficient use is confined to flat material mounted on cards (4" x 6"). The maximum photograph or sketch projected by this machine is 4¾" x 4¾" which will show on the screen as follows:

Distance from Screen	*Size of Image*
7 ft.	27 in. square
10 ft.	41 in. square
12 ft.	49 in. square
14 ft.	51 in. square

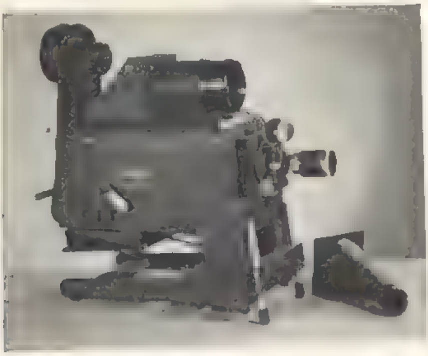
15-16. "Baloptican" — dual-purpose, opaque projector for opaque projection, also 3¼" x 4" slides. (*Courtesy Bausch & Lomb Optical Co.*)

A resourceful vocational or industrial arts teacher can easily construct an opaque projector at a minimum of expense.

The unit shown in Figure 15-15 can accommodate a wider range of material for projection. It is so constructed that it can project pages from an ordinary text or reference book. The projected area is limited to 8½" x 11". It is not cumbersome to handle, and therefore it is readily portable.

Figure 15-16 shows a combination opaque machine known as a Balopticon used for the projection of flat surface material and also for 3¼" x 4" glass slides. This machine has two lens systems: the large for opaque use; the small, set in a long metal housing, for slides. Either system may be selected by means of a control handle at the side of the machine. This added feature increases its utility and is to be desired if glass slides are use extensively. This unit has a blower or fan installed in it which removes the danger of scorching the flat pictures and cracking the glass slides.

The machine shown in Figure 15-17 is a tri-purpose opaque machine known as a Delineascope. It will project flat surfaces 3¼" x 4", glass slides, and 35-mm slide films. This more versatile machine is desirable in certain situations. The purchase of an opaque projector depends on the specific purpose for which it is to be used as well as other projection apparatus that is available in the school. It is advisable to determine how and by whom the machine is to be used and the amount of projection equipment to be purchased. Manufacturers' catalogues should then be examined to be followed by a

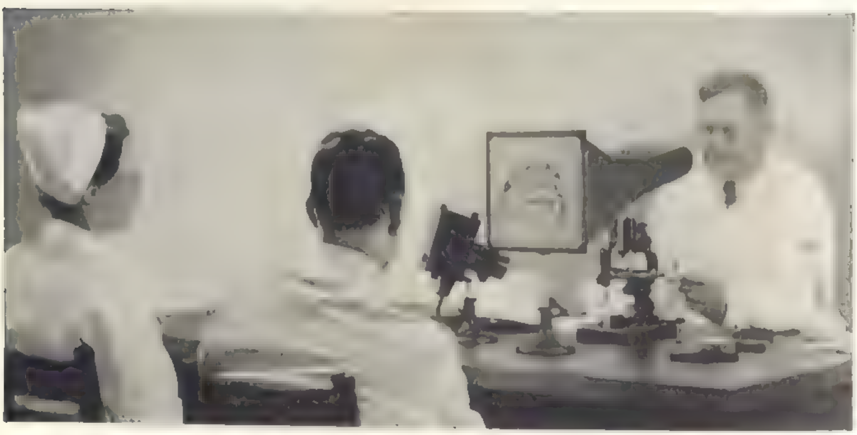


15-17. "Delineascope" — triple-purpose, opaque projector with attachments. Accommodates opaque material, 3¼" x 4" slides, and 35-mm slide film. (*Courtesy American Optical Co.*)

demonstration. Such a procedure will insure the purchase of equipment suitable to the visual aids program.

The Euscope is a device used with a regular laboratory microscope and is similar to the opaque projector. Figure 15-18 shows this piece of apparatus in use. It has several advantages:

1. It may be used for photomicrography by the addition of a special camera attachment which fits the Euscope and thereby converts the Euscope into a photomigrographic camera.
2. It gives the individual an opportunity to view microscopic objects with both eyes. The Euscope fits snugly over the eyepiece of the microscope and throws an enlarged image of the magnified object through a prism on a ground glass screen.



15-18. "Euscope"—opaque projector for use as shown. (*Courtesy Bausch & Lomb Optical Co.*)

There is considerably less eye fatigue when using the Euscope than when using the microscope alone.

3. It may be used for microprojection. The viewing attachment shown in the illustration enables the students to view magnified objects while the teacher manipulates the microscope and points out the important features to be observed.

Sono-Vision Projector

The 16-mm motion picture Sono-Vision Projector shown in Figure 15-18a has considerable promise for general school use. It is a

compact unit including all the essential accessories for satisfactory projection—projector, screen, reels, amplifier, speaker and controls. The picture is projected on the screen (21″ x 29″) in the cabinet from the rear. Therefore, the operator does not need to darken the room, set up a screen, and make the usual preparation for a showing. Also this projector has a specially developed continuous reel on which the same film can be run repeatedly without rewinding.

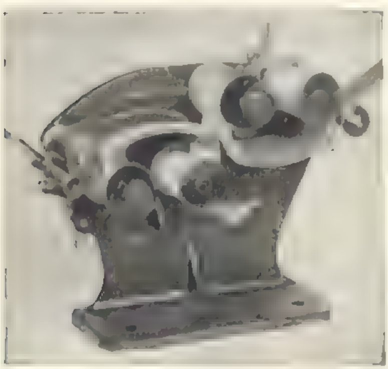
15-18a. Sono-Vision Projector—projection comes from the rear of the screen. (*Courtesy Mills Industries, Inc.*)

Film Center Accessories

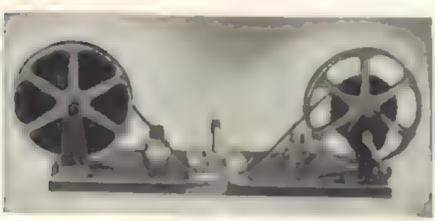
If a film program is to be handled efficiently, facilities for safe storage and maintenance of film and equipment must be provided.

1. *A Projection Table* should be sturdily built, have ample space for the projector and shelves for the accessories. A tilting attachment is a very necessary additional feature. The table shown in Figure 15-19 has these features. Size: 30″ long, 16″ wide, 36″ high.

15-19. Projection tilt table. (*Courtesy Neumade Co.*)



15-20. Film polisher and cleaner. (*Courtesy Neumade Co.*)



15-21. Rewinder and splicer. (*Courtesy Bell & Howell Co.*)

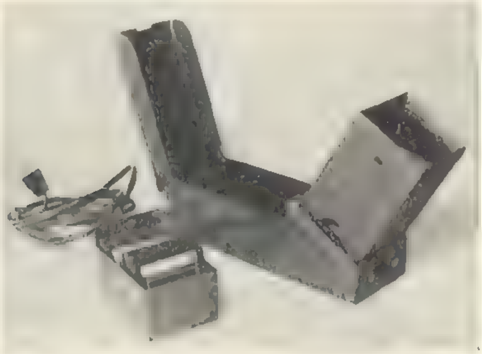
2. *A Film Polisher and Cleaner* is a desirable adjunct to a film center or laboratory. Naturally film becomes dirty and soiled from use. To remedy this a gadget shown in Figure 15-20 is required. It may be used for positives or negatives and will polish and clean both sides in one operation.
3. *Film Splicer—Viewer* and *Rewinder.* This is one of the most essential accessories of a visual aids center. It is possible to purchase these items as independent units or in various combinations of which the splicer and rewinder shown in Figure 15-21 is the most common. The outfit shown in Figure 15-22

15-22. Film editor. (*Courtesy Bell & Howell Co.*)

is exceedingly convenient. As the film is drawn through a scratch proof channel, pictures appear as actual miniature movies on a brilliantly illuminated glass screen 2½″ x 3″. This arrangement makes it easy to spot the damaged frame where the splice must be made.
4. *Slide Viewer.* This is a very convenient and time-saving accessory. One can view a series of slides in an office without projecting them on a screen. The slides are illuminated and magnified and one has the advantages of regular projection. If a few slides are to be used, they may be placed in the small container at the left (Figure 15-23), which is an integral part

of the viewer. This is a very compact unit as shown in the closed position (Figure 15-24).

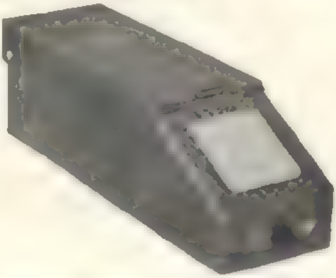
5. *Tripod.* A tripod shown in Figure 15-25 is very convenient when using a slide or film-strip projector. The projector may be mounted permanently on the tripod and is always ready for use in any desirable location. When not in use, it should be suspended by a bracket in the storage cabinet.



15-23. Slide viewer in working position with slide box.

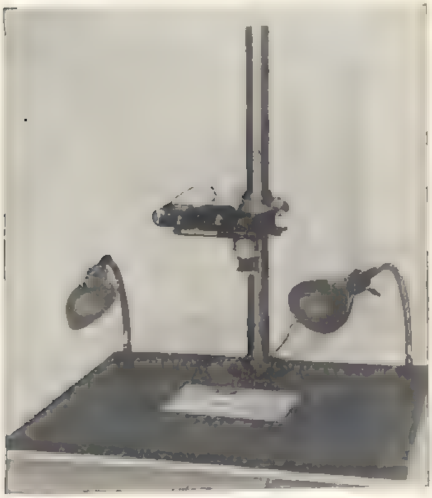
6. *Copying Stand.* This piece of equipment is essential when making 2″ x 2″ slides. It meets all practical demands of the job and is very inexpensive. The types shown are school made. The materials used are to be found in any vocational school.

The base in each case is a drawing board of convenient size. The column is a piece of 1½-inch pipe finished in a lathe with an ordinary pipe flange on the bottom to attach it to the board. The brackets holding the lamps are common flexible



15-24. Slide viewer showing compactness when closed.

15-25. An adjustable tripod to increase portability of slide film projector.



15-26. Inexpensive home-made copying stand with camera and copying attachment in position.

conduit in one case and in the other they are strips of suitable metal so constructed as to allow flexibility for easy adjustment. A convenient control switch is shown in the lower left of Figure 15-26. The table is made of angle and strap iron welded together. The bracket on the column is simple to make in any school machine shop. It is made to slide up and down the column with a knurled screw to hold it in position. The camera with copying attachment is mounted on the shaft that extends from the bracket.

15-27. Easel convenient for the display of charts and similar materials.

7. *Easel.* An easel is a most necessary and convenient article in a visual aids program. It is used for the display of chart material. The easel illustrated (Figure 15-27) is cleverly and simply constructed. Every instructor will find it advantageous to have this accessory that can be made so easily in school shops.

Film Storage

A variety of convenient storage cabinets will be found in Chapter XII, Handling, Maintenance, and Storage of Films.

Conclusion

Equipment should not be purchased hastily because of the wide range of projection devices and laboratory equipment available. Plan your visual aids program first and then select the equipment with which you can accomplish your objectives. Consult various equipment dealers, solicit the opinion of people who have used the machines and devices, and finally choose that equipment that will satisfy your particular needs.

References

Distributors of Motion Picture Projectors and Supplies

1. The Ampro Corporation
   2839 N. Western Avenue, Chicago, Ill.
2. Bell & Howell Co.
   1815 Larchmont Avenue, Chicago 13, Ill.
3. DeVry Corporation
   1111 Armitage Avenue, Chicago 14, Ill.
4. Eastman Kodak Stores, Inc.
   356 Madison Avenue, New York 17, N. Y.
5. Movie Mite Corporation
   1105 E. 15th Street, Kansas City 6, Mo.
6. Radio Corporation of America
   Educational Department
   Camden, New Jersey
7. Victor Animatograph Corp.
   Davenport, Iowa

Distributors of Recorders—Recordings

1. The Brush Development Company
   Cleveland, Ohio
2. Sears Roebuck Co.
   Philadelphia, Pa.
3. The Soundscriber Corporation
   New Haven, Conn.
4. Webster Company
   5610 Bloomingdale Avenue
   Chicago 39, Illinois

Distributors of Screens

1. Da-Lite Screen Co., Inc.
   2723 Crawford Avenue, Chicago, Ill.
2. Motion Picture Screen & Acc. Co.
   351 W. 52nd Street, New York City
3. Radiant Mfg. Co.
   411 Irving Park Road, Chicago, Ill.
4. Williams, Brown and Earle, Inc.
   918 Chestnut Street, Philadelphia, Pa.

Distributors of Slide, Film Slide and Opaque Projectors

1. American Optical Company
   Buffalo 15, New York
2. Bausch & Lomb Optical Co. (Opaque)
   Rochester 2, New York
3. Charles Beseler Company (Opaque)
   243 E. 24th Street,
   New York 10, New York
4. DeVry Corporation
   1111 Armitage Avenue
   Chicago 14, Illinois
5. Gold E. Mfg. Co.
   1222 E. W. Mackson Street
   Chicago, Illinois
6. Keystone Mfg. Co. (Opaque)
   288 A Street
   Boston, Massachusetts
7. The Magnavox Corporation
   Fort Wayne, Indiana
8. Society for Visual Education, Inc.
   100 E. Ohio Street
   Chicago, Illinois
9. Spencer Lens Co. (Opaque)
   Buffalo, New York
10. Three Dimension Co.
    500 N. Dearborn Street
    Chicago, Illinois
11. Victorlite Industries (Opaque)
    2414 West Slauson Avenue
    Los Angeles, California

Magazine Articles

"Types and Use of Projectors" *National Elementary Principal*, June 1934, pp. 308-12.

"Audio-Visual Program Standards Equipment and Building Facilities," *See and Hear*, January 1948.

Fitzwater, J. F., "Planning A Visual Center," *Nation's Schools*, XXXII, August 1943, 58 ff.

CHAPTER XVI

Teacher Training in the Use of Visual Aids

One of the outstanding problems of any program involving visual aids is the adequate training of teachers to appreciate, to make, and to use properly these visual materials. Progress in the use of teaching aids will be very slow unless the classroom teacher is trained to employ them efficiently. Illustrations 1-2-3. School supervisors and administrators also should have a clear conception of the educational need and value of visual materials and their many adaptations. A great deal of time and care has been devoted to the selection of textbooks; a like degree of discrimination should be exercised in the choice of visual aids. Teachers and supervisors should be well acquainted with their possibilities and be able to evaluate them as teaching tools.

Teachers' Fear of Films

It has been implied in some educational circles that the wide use of film may replace the teacher. That point of view is absurd and is not shared by thoughtful film producers or educators. The educational film must be considered as an aid to instruction and a supplement to the teacher's efforts but never as a substitute for the teacher. If teachers will hold to that point of view, they need have no fear of an attack on their security.

Teachers should use educational films and learn how to use them to the best advantage. "With this kind of teaching film, more planning, more rehearsing, more thought, more timing, more selection of just the right delivery goes into the ten, twenty, or thirty minutes of instructional time occupied by the film than in almost any other comparable period of teaching. This kind of film does not replace the teacher. It puts at the teacher's disposal the finished presentation which is the result, not of a few minutes or a few hours of prep-

aration, but of weeks and months of preparation by the finest subject-matter specialist and the finest talent of film making and film teaching."[1]

Training Courses

Instructors in teacher training institutions have a very profound influence on the prospective teachers enrolled in their classes. "Teachers are inclined to teach the way they were taught rather than

16-1. Teachers making 3¼″ x 4″ hand-made slides using a home-made mimeoscope for convenience and to show the immediate results of their work.

to teach the way they were taught to teach." If this is true, the instructors in teacher training institutions should use visual aids by applying them in their own teacher training courses and thereby practice what they preach. In this way the prospective teachers are indelibly impressed with the pedagogical and psychological importance of visual curriculum materials.

All teachers and prospective teachers should be exposed to a

[1] Hoban, C. F., *Movies That Teach*, New York, Dryden Press, p. 104.

well-planned and integrated program of visual education that includes a wide range of teaching materials for use in teaching their chosen subject. A comprehensive training program should include the making and use of charts, posters, models, display boards, graphs, bulletin boards, stereographs, motion pictures, film strip, blackboards, and other devices having eye appeal.

The teacher is the important factor in any visual program. Consequently he should possess certain skills and abilities in, as well as knowledge and understanding of, this field of work.

A. Skills and Abilities

Teachers should be able to:

1. Use visual aids effectively in the classroom.
2. Plan and arrange the best possible physical conditions for advantageous use of teaching material.
3. Select the appropriate visual materials for specific situations and student needs.
4. Evaluate the technical and educational worth of the various visual materials.
5. Measure the effectiveness of various teaching aids and adjust or change them in accordance with the demands of the teaching situation.
6. Operate, lubricate, and service, within limits, various projection and duplicating equipment.
7. Display effectively interesting materials on the bulletin boards and in display cases.
8. Make posters, slides, models, graphs, and other desirable materials.

B. Knowledge and Understanding

In addition to having certain skills and abilities, it is necessary that teachers

1. Should know the sources of desirable teaching aids which are free or distributed at a nominal cost by local or national organizations.
2. Should know the extent of visual aids available in their subjects and their potentialities as learning media

3. Should know techniques for proper maintenance, filing, and storing of materials and equipment.
4. Should know the important features of various types of projection and duplicating equipment.
5. Should understand the psychological basis underlying the use of visual teaching aids in the classroom.
6. Should understand the organization of a visual education program in a school.
7. Should understand methods for maximum use of visual materials.

It is possible for teachers to encompass the skills and knowledges indicated above. However, they should take formal training in this work rather than depend on some informal, unorganized, personal efforts. Teacher training institutions and local school authorities, therefore, must make provision for the desired instruction.

There are three aspects of the problem that need attention:

1. The pre-service training of shop and classroom teachers in the selection and use of training aids for the classroom. This should be a specialized course given by one who is experienced in this field. It is not probable that a regular methods teacher will have had sufficient experience to handle this specialized work. Furthermore, the subject would not receive proper treatment if included in an already crowded methods course.

2. The training of visual aids leaders who can make various types of visual aids as well as organize and administer visual aid programs in large schools or centralized bureaus in medium-sized cities. Instruction of this kind must be given by a number of specialists who are fully competent in their particular field and who are aware of the possibilities of their medium of instruction. For example, the making of hand-made slides should be taught by an expert who not only can make a variety of kinds of slides but also can demonstrate all their uses.

The administrative and supervisory aspects of such a course should be taught by the director of a big city program. He will have experienced, first hand, the problems that arise and will be able to provide practical solutions. His position and experience will give the course the prestige that is required to demand and retain the

respect of prospective directors and administrators. Such a course should be available through summer schools and extension courses.

3. The in-service training of teachers to stimulate and maintain continued interest and enthusiasm in teaching aids by the presentation of new techniques and sources of new material. Universities and teacher training institutions will offer the courses which will provide the desired instruction under 1 and 2. The in-service training mentioned here may be provided by formal courses. These can

16-2. Teachers making charts and blackboard drawings by using the blow-up method.

be given very satisfactorily by the visual aids director, if such a person is appointed. This in-service assistance to teachers does not always need to be a formalized course, but may be informal help ranging from individual aid to group conferences.

The assistance given by the director should be inspirational and informational. The average person is not too resourceful and therefore needs to be stimulated and guided. The director's office should be a clearing house for ideas for teaching aids, new techniques of approach, and additional sources of useful material. It is this type of information that must be passed along to the average group of teachers.

This in-service training must be a continuous process if the visual aids program is to be kept alive and not allowed to disintegrate. In addition to individual help and group conferences, it is necessary to expose teachers to other forms of motivation. They should be informed periodically of new visual materials available through the local center or through outside sources. This may be accomplished by a timely bulletin or monthly list to be sent to each teacher.

16-3. Teachers in the dark room making enlargements. The home-made copying stand in the center of the pictures makes use of fluorescent bulbs for better distribution of light.

Exhibits should be arranged at least once a year to coincide with a teachers' convention or other type of city-wide teacher assembly. Prior to such an exhibit a contest for teachers might be organized. Recognition of some type should be given or cash prizes awarded for the best-designed and most unique visual aids made by teachers to satisfy a recognized need. The contest should be based on subject-matter areas, such as mathematics, drawing, science, electrical work, machine shop practice, etc. This idea is not only a motivating force

for teachers but also a measuring tool for the administrator to determine the real interest in visual instruction.

Course Content

A comprehensive training curriculum in the production, use, and supervision of visual aids will include three distinct courses:

A. The Use of Available Teaching Aids
B. The Design and Making of Desirable Aids
C. The Operation of Projection and Duplicating Equipment

Each of the courses will consist of a number of activities. The following outlines suggest the content that should be included in such training.

Course A. The Use of Available Teaching Aids

1. Use of motion pictures—sound and silent.
2. Use of slide films—sound and silent.
3. How to evaluate films—motion and slide.
4. Use of slides—2″ x 2″ and 3¼″ x 4″.
5. Use of charts, diagrams, graphs, cartoons, flat pictures.
6. Use of stereoscope.
7. Use of opaque projector.
8. Use of blackboard.
9. Use of textbooks and handbooks.
10. How to handle school journeys.
11. How to solicit commercial aids from manufacturers.
12. How to prepare lesson plans and student guides when using motion pictures.

It is possible to cover the foregoing activities in a course of 30 clock hours with a group of ten students, provided the work is well organized. Each student should have the opportunity to practice briefly, using each type of aid. In this same course the teachers should be advised concerning the sources of available aids indicated above. Each teacher should compile a detailed list of source material for his particular subject to the exclusion of all other subject

Course B. The Design and Making of Desirable Aids

1. What constitutes a good aid.
2. Special features in the design of the different types of aids—shape, size, color, materials, animation, etc.
3. Ways of improving commercial charts for educational purposes.
4. How to make good mimeograph stencils.
5. How to make hand-made slides.
6. How to make photographic slides.
7. How to make baloptican blow-ups.
8. How to make photographic blow-ups.
9. How to design and construct models.
10. Short-cuts in blackboard drawing.
11. How to mount, label, preserve and store visual materials.

Despite the availability of commercial teaching aids, every teacher should be able to make his own. The best aid is the one for which the individual teacher has felt a distinct need. If experts are employed to teach each phase of the course, the work can be covered in approximately 60 clock hours.

Course C. The Operation of Projection and Duplicating Equipment

The use of many teaching aids depend on the efficient operation of certain equipment. It is therefore advisable that teachers secure such training in order that they may be self-sufficient. The following suggestions are offered for the content of such a course.

1. Operating a sound and silent motion picture machine:
   a. Assembling and dissembling equipment.
   b. Function of various parts.
   c. Explanation of optical system.
   d. Threading the film in the machine.
   e. Positioning machine for screen size.
   f. Proper framing of image on screen.
   g. Adjusting of focusing attachment.
   h. Adjusting of sound attachment.
   i. Explanation of electrical connections.

   j. How to attach film to empty reel.
   k. Rewinding film.
   l. Oiling proper places.
   m. How to replace projection lamp.
   n. Replacing exciter lamp.
   o. Examining film for damage.
   p. Cleaning films.
   q. How to splice film.
   r. Cleaning optical equipment.
   s. Proper storage of film.

2. Operating a slide film projector:
   a. How to insert lens holder.
   b. Function of various parts.
   c. Method of inserting film.
   d. Technique of framing picture.
   e. Adjustment of elevating attachment.
   f. Removal and replacement of filter glass.
   g. How to thread film into rewind can.
3. Operating a sound slide film projector:
   a. Explanation of operating mechanics.
   b. Placing record on machine.
   c. Inserting needle in tone arm.
   d. Purpose of switches.
   e. Adjusting sound control.
   f. Dismantling machine.
   g. Placing in carrying case.
4. Use of opaque projection:
   a. Operation:
      1. Optical basis on which projection is accomplished.
      2. Operation of switches.
      3. Use of fan for cooling.
      4. Elevation control.
      5. Cleaning of lens.
      6. Adjustment of focus.
      7. Handling copy folder.
      8. Adjustment of machine to use slides.
   b. Protection of pictures:
      1. Line drawings.

2. Halftones.
3. Colored illustrations.
4. Book pages.

c. Projection of objects:
   1. Opaque or plastic article.
   2. Use of hands to manipulate device.
   3. Use of pencil or fingers for "pointing out" details.

16-4. A late model of a mimeographic machine with power drive. (*Courtesy A. B. Dick Co.*)

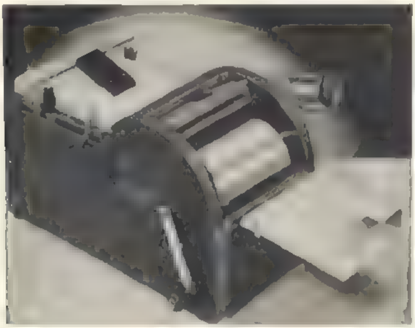
d. Mounting projection material on:
   1. White or colored cards.
      (a) Cellophane for protection.
      (b) Lacquer or shellac to preserve.

5. Operating a mimeograph (Figure 16-4) or other duplicating machine—to include:
   a. Placing and removing stencil.
   b. Inking the machine.
   c. Changing ink pad.
   d. Locating guides and paper.
   e. Handling quantity of paper.
   f. Removing and cleaning feed rollers.
   g. Avoiding static electricity.

h. Setting counter or recorder.
i. Adjusting for margin top and bottom.
j. Feeding by hand or machine.
k. Conditioning machine while not in use.

Note: The manufacturers of the various duplicating machines provide manuals of operation which may be used as text material when training students.

6. Use of liquid duplicator (Figure 16-5) to produce a two-color job:
   a. Mounting master copy sheet.
   b. Setting adjustments for pressure, fluid supply and priming.

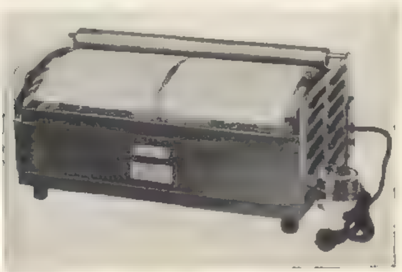


16-5. Rexograph liquid duplicator.
(*Courtesy Rex-o-graph Co.*)

   c. Replenishing fluid supply.
   d. Reversing and renewing fluid wick.
   e. Placing and adjusting copy paper and card supply.
   f. Setting counter.
   g. Removing and filing master copy.
7. Use of hectograph:
   a. Moistening the gelatin pad.
   b. Applying master copy.
   c. Applying and removing copy sheets.
   d. Preparation of gelatin surface when not in use
8. Preparation of copy for photo-offset duplication
   a. Selecting illustrative halftones and photographs
   b. Preparing "dummy."

c. Allowing for reducing or enlarging.
d. Marking line drawings.
e. Typing or lettering copy.
f. Mounting halftone drawings and photographs.
g. Allowing for margins and punching.

9. Solar printing frames (blueprints and ozalid prints):
   a. Placing tracing and printing paper in frame.
   b. Exposing to light source.
   c. Washing, drying, and trimming blueprints.
   d. Using chemicals to intensify and fix prints.
   e. Developing and trimming ozalid prints.



16-6. Spee-Dee Printer—used to produce blueprints, ozlid prints, and other kinds of prints, from original drawings or tracings. (*Courtesy Peck and Harvey Co.*)

10. Spee Dee Printer (Figure 16-6):
    a. Mounting tracing and printing paper on glass cylinder.
    b. Fixing cover over tracing and paper.
    c. Setting time switch to secure density.
    d. Printing.
    e. Developing exposed prints.
    f. Replacing burned-out bulbs.

Conclusion

If every teacher receives the suggested range of training in the making and use of visual aids there will be a renewed and intensified interest by students in their school subjects. It will do more to motivate student learning than anything that has developed in education during the past half century. Every teacher training institution, every superintendent of schools, administrator and subject

supervisor should not only approve such courses but also feel a definite responsibility for such a functioning program of teacher training.

References

Moore, Robert H., "Teacher Training in Audio-Visual Materials," *See and Hear,* November 1947, p. 26.

Zeiler, E. J., "Meeting Teacher Problems," *See and Hear,* November 1947, p. 24.

"Audio-Visual Program Standards—In-Service Training," Part I and Part II, *See and Hear,* November 1947.

Stallings, P. M., "Producer's View of School Made Films," *Audio Visual Guide,* April 1948.

"How To Make Good Movies," Eastman Kodak Company, Rochester, New York.

"Fundamentals of Mimeograph Stencil Duplication," A. B. Dick Co., Chicago, Ill.

Hoban, C. F., *Movies That Teach,* New York, Dryden Press.

CHAPTER XVII

Needs and Trends in Visual Education

In this chapter will be indicated the present accomplishments, the anticipated needs, the desirable improvements, and the possible trends in Visual Education.

Evaluation

The evaluation to be considered at this point is concerned with the major aspects of a visual program. The evaluation of classroom films by the teacher and the resultant student reaction were discussed earlier in connection with the form on page 203.

The following questions are posed to measure the adequacy of the equipment, the co-operation of the teachers, and the leadership on the part of the director or other persons responsible for the work. This procedure not only will show the effectiveness of the program but also will uncover additional equipment requirements, further training needs of the teachers, and shortcomings of the administration.

A. *Equipment*

1. Have the motion projection machines been satisfactory? Have the suggestions and recommendations of the teachers been heard on this matter? Their comments on the portability and convenience of the machines will be worth while.
2. Has the equipment been maintained efficiently? Are the screens in good repair; do the sound controls work properly; are the shades and other darkening devices in working condition?
3. Is a supply of necessary spare parts on hand? Have embarrassment and inconvenience occurred because spare parts were not available when a "break down" happened?
4. Is the number of slide and slide-film projectors sufficient to

meet the demand? Do the teachers limit their use of slide films because of the lack of a projector when needed?

B. *Distribution*

1. Has the system of distributing projectors eliminated all confusion? Do teachers experience inconvenience because of the failure of machines to arrive from the distributing center or because of lost and broken parts?
2. Is the system of ordering and distributing films simple and efficient, or is the system cumbersome to the point where it discourages the use of films?

C. *Budget*

1. Has enough money been budgeted to maintain and improve the program? Will the funds available permit necessary replacement and allow for the purchase of additional desirable equipment?
2. Have the records been sufficiently complete to indicate whether or not it is advisable to purchase rather than rent frequently used films?

D. *Teacher Training*

1. Does every teacher know how to operate the equipment—especially a slide film and opaque projector?
2. Has instruction been available whenever requested?
3. Have group conferences been held for teachers who teach the same subject matter?
4. What positive ways of advising teachers of new material have been used?
5. How many calls have been made upon the director or visual aids center for individual assistance?
6. How many classroom visits have been made by the person in charge to observe how well the teaching aids are being used?

E. *Storage*

1. Are the storage facilities adequate to prevent loss, deterioration, or theft?
2. Are the various articles of equipment carefully indexed in order that they may be easily located?

3. Are the transportation containers properly labeled and in good condition?

F. *General Criteria for Measuring Progress*

1. How many films have been used during the year?
2. How many special teaching devices have been made by teachers?
3. What has been the student reaction to films? Is there evidence of changed attitudes to their school work—an awareness and interest that were not present beforehand?
4. Do parents enthuse over the greater interest taken by the youngsters?
5. What controlled experiments have been conducted to measure the increased learning of the students?

Needs

The motion picture industry has provided a wide range of pictures covering many and varied subjects for public entertainment. The directors and photographers of this industry are masters of the many techniques that are essential to box office patronage. Their objective has been entertainment by the use of animated drawings, trick photography, accelerated motion, attractive color, and emotional appeals of varied character. Recently these same producers have directed some of their time and energy to the production of educational films of various types. In general, they have applied some of the same procedures of good showmanship, but they have left something to be desired from the educational point of view. It is not the purpose of this discussion to weigh the merits of specific projected pictures, by whomever produced, but an effort will be made to direct attention to certain factors that will make pictures a more effective vehicle of learning when used for instructional purposes.

For all practical purposes, educational pictures may be divided into two general classifications. The first group may be designated as *informational films.* They comprise those pictures that present general information about things that are of interest to the layman as well as to the student. These films are used to supplement the instructor's own efforts of explanation and narration in his attempt

to give an overview of places, things, people, and processes. The chief value of this type of picture is informational and generally demands no exacting sequence of presentation to make it interesting.

The second group of educational pictures may be labeled as *learning films.* Their chief objective is to impart specific cultural, scientific, industrial, or occupational information as well as to demonstrate performance skills to be learned by the observer. If these films are to render maximum service, they must be planned with a full knowledge of how people learn and they must take nothing for granted. The approach, the sequence of facts presented, and the order of skills demonstrated must be in accordance with the scientific laws of learning. It, therefore, appears advisable to suggest that the production of films for teaching purposes should be a joint effort of producers and teachers who will use them. The co-operation of these two interested groups will insure mutually advantageous results in better films, bigger sales, and improved instruction. Such co-operation, to be sure, has often been effectively achieved; nevertheless, careful investigation brought to the surface certain shortcomings.

1. The average motion picture film for educational or training purposes usually covers too much territory. Human beings can absorb only a limited amount of knowledge in one learning period and therefore no attempt should be made to cover the whole of a complicated subject.
2. The motion picture moves too rapidly for satisfactory comprehension of the learner. The pictures and comments usually move too fast for a good learning situation.
3. The explanation of technical terms is too limited, if not omitted in many cases.
4. There is not sufficient "pointing out" of parts of machines, operations, and processes to which the running comment is directed.
5. There is need for a more adequate review of pertinent points or summarizations for thorough understanding.
6. Things are taken for granted. It is assumed that the learner will understand what is being done, therefore, details are omitted.
7. Motivation, many times, is lacking. No situation is created

that causes the learner to want to learn the particular thing presented.

8. The explanations and demonstrations are not well co-ordinated in some presentations. The tools, appliances, gages, controls, etc., should be explained as they are introduced and as they become necessary for doing the work.
9. There exists a lack of sufficient slow motion, close-ups, or "shots" at the proper angle for complete clarity.
10. Dramatization of the learning situation is often omitted. The picture is more impressive, for instance, if it depicts an instructor teaching a learner.

What the Producer Can Do

The resistance or reluctance on the part of some teachers to use motion pictures for instructional purposes is due in part to the pedagogical deficiencies of the pictures indicated above. Instructors are inclined to think they can teach more effectively without films if they must add so much to the film presentation. There are, of course, a limited number of instructors who consider it too much trouble to plan ahead for film showings. In order to reduce excuses for not using films to a minimum, the following suggestions are made for the production of instructional films:

1. Enlist the services of teachers who are expected to use films in developing plans to shoot each picture.
2. Break down the film into short units of instruction that they may be understood and absorbed by the learner within a period of 10 or 15 minutes.
3. Be sure every new or technical term is clearly explained. This precaution will avoid much confusion.
4. Indicate by finger, pointer, or animated arrows parts or processes to which the running comment is directed. This suggestion will definitely assist understanding.
5. Take into consideration the laws of learning for guidance when considering the length of the film, the sequence of content, and the approach or introduction to the subject.
6. Do not fail to repeat important features; also, review at intervals and summarize for added emphasis.
7. Motivate the learning by creating a need for the instruction

in the learner's mind as a preliminary to the presentation of the information or skills involved.

8. Take nothing for granted—underestimate rather than overestimate the learner's intelligence. Explain and demonstrate details.
9. Make generous use of close-ups and retarded motion for the sake of complete comprehension.
10. Do not befog the learning situation by irrelevant showmanship. Remember educational films should teach, not entertain.
11. Avoid abrupt changes in the presentation of the subject matter. Make the transition clear by a few extra frames.
12. Provide with each film a brochure in which are indicated the most effective ways of using the film. This treatise might suggest the various situations in which the film may be used, questions for interrogating the learners after the showing, and practical assignments that may be given to insure the proper application of the knowledge gained.

The pioneering efforts so far in educational film production have been very commendable. This is particularly true of the training films produced through the initiative and guidance of the Federal Department of Education and certain producing companies. Most of the improvements suggested here have been applied in these films.

Recommended Type of Pictorial Media

A very limited amount of research has been done to ascertain the effectiveness of various types of films. There is a tendency, however, on the part of many teachers to favor the silent film strip. This type of film is chosen as most desirable because of its ease of operation, minimum cost, and educational return to the students. In this case the speed of showing and the explanation of the pictures are under the control of the instructor, which is a decided advantage.

There are many situations that only a motion picture can present adequately. The motion picture is necessary to show the functioning of hidden parts or invisible processes, the acceleration of slow action and the retardation of motion too fast for the eye to observe and analyze. It is highly probable in the near future that more

motion pictures will be produced and supplemented by slide films. The latter will show close-ups and stills of parts of the motion picture in order that the instructor can further explain the details and the learner gain a clearer understanding of them. The superiority of a silent or a sound motion picture over a film strip for immediate effective learning and recall has not been proved. The restricted amount of experimentation on this matter will not permit a valid decision on this question.

The whole field of pictorial media for educational purposes is still more or less in the embryo state of development. Private and public funds have and will continue to be utilized for the development of training films. There is a need at this time for still closer co-operation between producing agencies and educators in order that films may represent the finest possible co-ordination of pictorial showmanship and accepted pedagogical procedures.

Suggestions to Civilian Educators from Military Training Officers[1]

"The training divisions of the Army and Navy both issue film and film-strip catalogues for the benefit of training officers and unit commanders. Both Services also make use of a staff of utilization and evaluation officers who visit training installations constantly. There they serve as consultants to training officers, observe the use of the various aids, make pertinent suggestions, evaluate the effectiveness of individual items found in use, and review new ideas and suggestions made by local training officers and unit commanders. The Training Aids Center of the Army Air Forces utilizes a civilian staff member, a professional educator, whose task is to range the various training installations of the Air Forces as a scout for new ideas in training equipment and materials. Local officers are encouraged to develop new ideas and to make recommendations to higher authority for their use or adoption. Local officers are permitted, of course, to make small adaptations and elaborations, and to improvise supplementary materials, but not to depart from the aids and materials specifically prescribed in training manuals. It will be understood that training must be carried on substantially as prescribed in order to insure a uniformly trained product.

"The Committee believes that the Armed Services programs for the creation, distribution, and utilization of training aids, devices,

[1] Taken from U. S. Bulletin, "Training Aids in the Armed Forces."

and materials, are worthy of serious consideration and study by civilian educators. The question is especially pertinent for State departments of education; large, medium, and small city school systems; vocational schools, colleges, and universities; or any administrative educational area in which there is an instructional program of sufficient scope and extent to justify a common approach. In civilian education we have relied greatly upon local and individual initiative in curriculum making and in the creation of subject matter materials. In so doing, we have felt that we were acting democratically; that we were stimulating local interest in local problems, thus providing for differences in local needs; and that we were stimulating professional alertness. These are undoubtedly highly desirable values and are worth while goals in the pre-training and in-service training of teachers, and in our operating philosophy. In some instances we have carried these principles to extremes, producing uneven and inadequate results, and great wastage of time, energy, and money. Those who have had charge of large programs or who have observed education over widespread areas daily see conscientious individuals engaged in "rediscovering America," or else sunk in unproductive lethargy. Teachers are seen creating lesson plans and supplementary materials, which many other teachers—even in the same system—are simultaneously duplicating in independent effort. Best practices are slow to be translated to wider effectiveness and must await the promotion of the professional publisher and equipment manufacturer, or the slow permeation through professional journals and other fortuitous means. Those familiar with instruction in the college classroom are well aware of the results of local autonomy in some of its extreme forms.

"The Committee does not desire to suggest that in civilian education centralized control of curriculum making or subject matter materials and aids is required or desirable. It does feel, however, that consideration might well be given to the creation in appropriate educational jurisdictions of a centralized training aids research and development center, where initial research would be carried on, through which recognition could be given to individual and local research and through which stimulation could be given to more extended and effective use of appropriate training aids and devices.

The Committee already has indicated that it has become increasingly of the opinion that the most important values to be derived

from the use of aids and devices in the training programs of the Armed Forces lie in the basic principles which are illustrated and supported by their use, rather than in the specific aids and materials which may have direct application in civilian educational programs. The Armed Services have utilized devices and materials to render more effective the application of almost every known educational or psychological principle and to further almost every known instructional objective. The great proportion of the aids created are aimed to assist in the direct teaching of skills, or in the building of facts and information. There has, however, been no lack of effort to attempt more abstruse and difficult objectives, such as the development of attitudes and general values not directly related to specific teaching situations.

"Civilian educators can well afford to study the techniques of the Army and Navy training divisions used during World War II. If we must dispense with certain of the benefits and advances resulting from the war training program we should at least salvage the extensive development and experiences with teaching aids in the form of charts, models, mock-ups, baloptican and photographic blow-ups, slide films, motion pictures and other visual teaching material. These ideas are not particularly new, but it required a war and its demands for immediate and efficient training to give new life and growth to these well-known techniques of instruction. The term "visual aids" is accepted by many persons as synonymous with motion pictures and slide film. The term means more than that—it means any supplementary teaching device that increases learning through the sense of sight. If teachers expect to improve their teaching by visual aids, their thinking must go beyond just film. There are many teaching situations in which a visual aids is most desirable but no film is available. In lieu of a film, a chart, a model, a mock-up or baloptican blow-up may render better service. If these aids are to be used, they must be developed and made by the individual teachers.

"It is interesting to note that in organizing their training programs, the Army and Navy have chosen to place great reliance upon the extensive use of training aids and devices coupled with rigidly dictated training methods. Among the most important reasons for such reliance upon aids and devices are:

1. Their use is thoroughly established as an educational method, although always regarded in civilian education as an auxiliary one.
2. They eliminate the monotony of verbal instruction, create enthusiasm and interest in the subject, and assist in standardizing training.
3. The creation and use of aids and devices could be expedited coordinately with other methods and not at the expense of time or the use of other means. For example, to try to create a trained corps of instructors prior to the initiation of the training program would have delayed unduly the beginning of training activities.

"The creation and procurement of training aids in the Armed Services has not been left to chance or to initiative of local commanders. The creation, distribution, and evaluation of the use of training aids have been given a place in the training staff picture commensurate with the reliance which has been placed upon them."

What Is Ahead in Visual Education

It requires no soothsayer to predict an ever-increasing use of visual materials in every field of human activity. Industry, business, the professions, and governmental agencies will extend their use of films and like materials to create further public interest in their work. Churches and pressure groups will utilize this media to propagandize in favor of their ideologies, activities, and points of view. The schools will have a relative increase in the use of visual material because of the impact of their use in out-of-school situations. World events are moving so rapidly and technological advances are so great that it is essential that we use the sense of sight to provide vicarious experiences to keep up with the march of time.

It is safe to say that every teacher training institution will be equipped with proper facilities to offer adequate courses for the training of teachers in the making and use of visual materials. Relatively speaking, teachers use a very limited amount of the visual materials at their disposal. This apparent negligence is due to a lack of information about existing material, a lack of appreciation of their educational value, and a lack of skill in their use. Furthermore, there is a dearth of leadership in stimulating the use of visual aids.

These statements are verified by factual data taken from a survey conducted in Illinois and reported in *Educational Screen*, October 1945.

"Of the 525 schools reporting, 386 feel their teachers are not getting the maximum value from the films. In way of explanation 37 report, 'the teachers just show the films'; 16 report, 'the teachers let the director show the film and lead the discussions'; 29 say, 'their teachers are not interested'; while 14 indicate, 'their teachers do not understand the function of the film as a teaching aid.'

"Only 46% of the teachers are previewing films before using them. However, many qualified their answers by saying, that more teachers would do so if projectors were available and more convenient.

"About 88% of the schools report that the newer industrial films are free from objectionable advertising. This has long been a bone of contention, and it is encouraging to note the long list of industrial films given by the schools as suitable for classroom instruction.

"Teacher training is still the major factor that will determine the expansion of the audio-visual program in our schools of tomorrow. Of these reporting, 94% feel that the teachers' lack of training hinders the development of their program.

"How shall this training be provided? The preference is as follows: First choice, 62% favor the short informal course conducted in their own school. This type of course is best suited for training of teachers in service.

"Second choice, 26% favor the formal extension course. An audio-visual instruction course can be handled exceptionally well by extension. It provides the teacher with ample opportunity to experiment with these aids in her own class room.

"Third choice, 12% favor the formal course as offered by universities or teacher training institutions."

It is more than probable that these handicaps will be overcome by improved training courses in our colleges and universities during the years immediately ahead.

Encouraging Trends

1. School boards are including in their annual budgets appropriations for audio-visual aids. Although the amount allocated

may be less than desired, it is sufficient to encourage plans for extended programs.

2. More classroom films on specific subject matter are being used. The use of films for school assemblies is on the increase.
3. Many schools have appointed one teacher to be in charge of the audio-visual program. The assignments are usually on a part-time basis which rarely gives adequate time for the proper development of the program. In the near future this phase of school work will become such a vital and necessary part of the whole educational program that a full-time director will be designated in the larger schools.
4. Teacher training institutions are offering courses for teachers in the construction and use of visual teaching materials. The whole visual program will depend on the extent to which teachers are trained in the use of these teaching aids and the operation of projection equipment.
5. Industrial films have improved from an educational point of view. The advertising features have been reduced to an acceptable minimum. Glamor has been sacrificed to the advantage of good educational procedures.
6. Films have been accepted as a very effective media for promoting, safety, health, community interest and pride, vocational guidance, and other desirable features of good citizenship. Someone has said, "the dynamics of these materials are not fully recognized unless they are also selected and used in terms of their potential capacity to build attitudes and appreciations, to give understandings, to develop skills and critical thinking, to present and interpret modern problems, to communicate real life experiences and to insure education against isolation from the stream of events."
7. Commercial film producers are considering schools as an integral part of their sales outlet. They are employing educators as advisors on films for school use. They are also soliciting industrial and commercial companies to sponsor films for educational purposes.

Text-Film

The time is fast approaching when a large number of textbooks will be supplemented with motion pictures and film strip. These

educational films are known as text-films because their content is correlated with the subject matter of a specific textbook. It is not the intention of publishers to duplicate the material in the text but rather to provide an extended coverage of the subject not possible in the book. In order that the film will not replace the teacher or textbook but serve as another teaching aid, the film strip will contain 30 to 40 frames and the motion picture will consume about 15 minutes.

The Society for Visual Education in co-operation with several publishers has initiated a textbook-film strip program. The McGraw-Hill, Silver Burdett, Rowe, Peterson, and American Book Companies have in preparation films of this type which will be available before the publication of this book. The McGraw-Hill Company says:

"Subject Matter in Text-Films will be directed to those parts of a course most difficult for students to understand, as determined from surveys among teachers, and to those parts of each book that can be effectively presented by the visual medium. Material to be presented in films on any one subject (i. e. for any one book) has been divided and organized into sections, the scope of each section being about what the average student can readily assimilate in one class period. A separate motion picture is being developed to cover each section, and film strips are being provided as follow-ups.

"Motion Pictures in this program dramatize facts and give realistic explanation of theories, principles, techniques, and applications. In addition, animated drawings, photomicrography, and slow-motion photography are used where they help the student to visualize what is normally difficult or impossible to see. Thus each motion picture will provide the instructor with a powerful medium for stimulating the student's interest in the subject, and for clarifying difficult points.

"Each Film strip is being designed to follow-up the corresponding motion picture. Since the film strip consists of a succession of individual frames that can be projected one at a time and held on the screen as long as desired, it is a splendid method of presenting material for more detailed examination and study by the group than the motion picture can permit. Primary functions of film strips in the Text-Film program are: offering additional factual material, re-

emphasizing key points in both textbook and motion picture, and presenting review questions. Thus they will be valuable for stimulating class discussion and review, and for combining the effective learning techniques of repetition and group participation."

This effort appears to be the beginning of a new epoch in education. There is every evidence to believe that teachers will welcome this assistance in their work. The success or failure of the projected program will depend on three things.

1. The training of teachers to operate projection equipment.
2. The proper classroom equipment such as a projector, proper screen, and convenient ways of darkening the classroom.
3. Adequate provision in school budgets to purchase the desirable films.

It is not being too optimistic to predict that text-films will be in common use within a relatively few years.

References

Periodicals Devoted to Visual Aids

1. *Business Screen*, 20 North Wacker Drive, Chicago, Ill. Information on advertising and industrial films.
2. *Educational Screen*, 64 East Lake Street, Chicago, Ill. The main source of information on current practices in this field.
3. *Film Forum Review*, Institute of Adult Education, Teachers College, Columbia University. Quarterly. Concerned with motion pictures for adult education.
4. *Film News*, The Penthouse, 15 West 38th Street, New York 19, New York. News of the 16-mm film field published 24 times a year.
5. *New Movies*, National Board of Review of Motion Pictures, 70 Fifth Avenue, New York 11, N. Y. Monthly. Official magazine of the National Board of Review, stressing the artistic achievement of commercial and educational film producers.
6. *See and Hear*, The Journal on Audio Visual Learning. September to May. E. M. Hale and Co., Eau Claire, Wisconsin.
7. *Visual Review*, An annual publication of the Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Ill. Contains articles written by specialists presenting a review of progress in work with motion pictures and slide films in a variety of educational situations.

Books

1. Arnspiger, V. C., *Measuring the Effectiveness of Sound Pictures as Teaching Aids.* Bureau of Publication, Teachers College, Columbia University. 1933.
2. Naumburg, N., *We Make the Movies* (Production to Cutting), New York, W. W. Norton Co., Inc. 1947.
3. Wittick, Walter Arno and Fowlkes, John Guy, *Audio-Visual Paths to Learning*, New York, Harper and Brothers, 1946.

Magazine Articles

Bettman, Madeline, "The Correlating of Projected Picture Aids with Textbooks," *Education Screen*, December 1947, p. 547.

Jones, Joseph, "The Filmstrip—An Examination Procedure in English Composition," *Educational Screen*, November 1947, p. 487.

Kruzner, Donald L., "Correlating Education Films with the Course of Study," *See and Hear*, December 1947.

Rosenberg, Albert, "Text-Films—New Teaching Films," *Educational Screen*, December 1947, p. 543.

Tobler, C. H., "The Next Decade of Visual Audio Use in 100 School Systems"—Part 1—*See and Hear*, December 1947.

———, "The Next Decade of Visual Audio Use in 100 School Systems"—Part 2—*See and Hear*, January 1948.

White, Thurman, "Audio-Visual Materials in Adult Education," *Educational Screen*, November 1947, p. 489.

National Committee of Fourteen—Audio-Visual Program Standards, *See and Hear*, November 1947.

Lemler, F. L., "A Critical Evaluation of Teaching Films," *Education*, LVIII, April 1938, pp. 479-483.

Goudy, Elizabeth, and Noel, Francis, W., "Evaluation Audio-Visual Aids," *The Business Education World*, XXIV, April 1944, pp. 438-441.

CHAPTER XVIII

Organization of Community Film Council

The idea of community film councils was conceived about 1942 and has had a remarkable growth since. The Office of War Information was seeking "new ways to promote the civilian war effort, to aid the sale of war bonds, and make more successful the numerous salvage drives." Seven national organizations were called upon to support the Treasury Department in its efforts. The groups that took an active part included The American Library Association, The Educational Film Library Association, and The National Education Extension Association. The commercial organizations invited to participate were The National Association of Visual Education Dealers, The Allied Non-Theatrical Film Association, and the Visual Equipment Manufacturing Council. This group formed the National 16-mm Advisory Committee.

During the war this group co-operated with the Office of War Information and the Treasury Department in showing 16-mm films throughout the nation to aid bond drives, to boost the public morale, and to assist in other civilian war efforts. The experience of the war period was convincing proof that such an organization would be valuable to promote the use of visual materials in peacetime, and consequently these organizations agreed to form The Film Council of America.

A constitution was adopted which provided that the Council's purpose be "to increase the information and work toward the general welfare of all people by fostering and promoting the production, the distribution, and the effective use of audio-visual materials." The organization guided by a board of trustees has established headquarters at 431 South Dearborn Street, Chicago 5, Illinois (Room 1228). Six of the board are from constituent organizations, the

others are representatives of the lay public. An ambitious program has been planned which sets a goal of 3000 councils by 1950.

The organization of a local film council is not a colossal task, but it does require an aggressive and resourceful leader. In the Organization Manual for Local Film Councils the following formula for a successful council is suggested: "To have a successful film council, a community brings together all the local people with program responsibilities, audio-visual aids specialists, and film producers, dealers, and distributors. They act together in a more or less formal organization. They have carefully planned programs at regularly scheduled meetings and sponsor continuing projects of definite community value. Each council is autonomous. But each is recognized all over America by the characteristics it has in common with many similar groups affiliated with the Film Council of America."

The idea of a film council is in harmony with every community adult education program. The Community Film Council should appeal to a wide range of organizations all of which are potential members. These community groups are:

1. *Service Organizations*

Rotary	Junior League	YMCA
Kiwanis	Chambers of Commerce	YWCA
Lions	Community Centers	Boy Scouts
Exchange	Church Leaders	Girl Scouts
Women's Clubs	4 H Clubs	Camp Fire Girls

2. *Fraternal Groups*

Masons	Elks
Knights of Columbus	Eastern Star
Shriners	

3. *Hobby Groups*

Garden Clubs	Boat Clubs
Fishing Clubs	Hunting Clubs

4. *School Groups*

Art Schools	Universities
Vocational Schools	Private Schools
Colleges	Parent-Teacher Associations

5. *Municipal Organizations*

Fire Departments	Police Departments
Museums	Civil Service Groups
Hospitals	Community Welfare Clubs

6. *Other Groups*

Political Clubs	Young Peoples Groups
Veterans Organizations	University Clubs
National Guard	Athletic Associations
Churches	Farm Association
Men's Clubs	

7. *Industrial Groups*

Foremen's Club	Trade Organizations
Labor Organization	Employee Clubs
Training Departments	Employer Groups
Technical Societies	Manufacturers' Association

8. *Professional Groups*

Engineers	Artists
Lawyers	Dentists
Doctors	Architects

9. *Farm Groups*

Grange	County Agents
FFA	Women's Groups
Co-ops	

There have been produced films, both motion and slide, that should be of specific interest to all these groups. Consequently very profitable and entertaining programs can be arranged which will result in community co-operation and development, agricultural improvement, business efficiency, professional progress, educational advancement, and social betterment.

How to Start a Community Council

Most groups of this type are formed by some outstanding individual who contacts by telephone or letter persons who may be interested in such a project. It is always easy to get a number of people

with like interests together if there are mutual advantages to be gained. The first meeting or two will be devoted largely to organizational matters. The first meeting may be concerned with such questions as: What are the advantages of a film council? Who shall be invited to become members? How often should the group meet? Where? What day and hour? What shall be the objectives of the organization? How will the activities be financed? A temporary chairman may be elected and a constitution committee appointed. Invitations should be extended to potential members to be present when the next meeting of the group is held.

A very clever approach to new members was made by the White Plains Chapter of New York. The following is a quotation from a letter sent to prospective members:

> Would you or your group like to—
> see films,
> use films,
> use more films,
> use films more effectively,
> use projectors correctly,
> know what films are available,
> know where to get films,
> know where to find appraisals of films,
> preview films before using them,
> preview films before ordering them?
>
> We thought so. Then come and delegate your program chairmen or others with film problems to attend the organization meeting of the proposed WHITE PLAINS FILM COUNCIL of the local Adult Education Council, to be affiliated with the Film Council of America.

The constitution of the Newark, New Jersey, Council is presented as typical for such an organization.

CONSTITUTION ADOPTED BY THE NEWARK FILM COUNCIL ON SEPTEMBER 19, 1947

1. NAME: This organization shall be known as the Newark Film Council.
2. PURPOSE: It shall be the purpose of this Council to serve, in the interest of all individuals and organizations, to stimulate the effective use of audio-visual material.
3. OFFICERS: a. This organization shall have as its officers a President, a Vice-President, an Executive Secretary, and a Treasurer.

b. The officers of this organization shall be elected for one year by a majority of the members present at the Annual Business Meeting in December of each year and take office in January of the following year. All elected officers must be members in good standing.

4. COMMITTEES: a. Appropriate committees shall be set up by the organization at their discretion to further the aims and the purpose of the Newark Film Council.

   b. The officers and the chairmen of the committees shall constitute the Executive Committee of the council.

5. MEETINGS: a. Meetings of the Executive Committee shall be held monthly with the exception of July and August. Special meetings of the organization may be called at the discretion of the Executive Council.

6. DUES: Membership dues shall be $3.00 a year, payable prior to the Annual Business Meeting in December.

7. AMENDMENTS AND BY-LAWS: Amendments to the Constitution or the By-Laws of this organization shall be made only at a regular meeting thereof, by a majority vote of the members present. No proposition to amend shall be acted upon unless written notice thereof has been given to the Executive Secretary prior to the meeting. A copy of such a proposition shall be embodied in the call for the next meeting, and a copy sent to every member of the organization at least ten days before the date of the next meeting at which the amendment is to be voted upon.

BY-LAWS

Officers

President

Section I. It shall be the duty of the President to preside at all meetings and to enforce all laws and regulations as to the administration of the Council.

Section II. He shall call meetings of the Council or Executive Committee when he deems it necessary or when requested so to do by the Executive Committee, or upon written request of at least one-fourth of the constituent members for a meeting of the Council. He shall appoint all committees.

Vice-President

Section III. In the absence of the President the Vice-President shall assume all the duties of the President.

Chairman Pro Tempore

Section IV. In the event of the absence of the President and the Vice-President from any meetings of the Council one of the members of the Executive Committee shall preside.

Secretary

Section V. All resolutions and proceedings of meetings of the Council shall be entered in proper books of the Secretary. The Secretary shall conduct all correspondence relating to the Council, shall issue all notices of meetings, and shall perform all duties pertaining to the office of the Secretary. The Secretary shall keep a register of the members of the Council.

Treasurer

Section VI. All moneys payable to the Council shall be paid to the Treasurer of the Council. All moneys payable by the Council shall be paid by checks signed by the Treasurer. He or she shall report at each meeting of the Council the condition of the treasury.

Executive Committee

Section VII. It shall be the duty of the Executive Committee to determine the policies and to plan activities of the Council, and to take charge, control, and management of all property belonging to the Council. They shall keep a record of the proceedings and make a report thereof in writing to the Council at the Annual Business Meeting in December. It shall be the duty of the Executive Committee to supervise the finances of the Council and audit all bills prior to the payment thereof.

Section VIII. The office of a member of the Executive Committee may be considered vacant by his or her absence from two consecutive meetings of the Executive Committee without good and sufficient reason satisfactory to the Executive Committee.

Committees

Section IX. The chairman of each committee shall be elected by a majority vote of the committee to which he or she was appointed by the President of the Council. Committee Chairman shall attend all Executive Committee Meetings. The President shall be a member ex-officio of all committees.

Committee Meetings

Section X. All Committees shall be subject to the call of their respective chairmen.

Quorum

Section XI. A representative majority of the members present at a meeting of the Council shall constitute a quorum authorized to transact any business at any meeting of the Council. A quorum shall consist of ten per cent of the membership or not less than ten members.

Members

Section XII. Any person or organization engaged or interested in the use of audio-visual material in the City of Newark or vicinity may apply for membership. Each paid membership shall be entitled to one vote.

If the local group wishes to be affiliated with the Film Council of America it may do so by applying for a charter from the governing board of the national organization. Although the local council is an autonomous body, it may be found advantageous to be in close relationship with the national body. There is a considerable amount of valuable national and international information that may be secured through this association.

Financing the Project

A nominal membership fee should be charged to defray necessary small expenditures. In a representative business group of this kind various needs may be satisfied gratuitously. Someone will offer to mimeograph notices of meetings, another will volunteer to provide suitable letterhead stationery, another will assume the obligation of telephoning members who are absent, and others will provide films without charge and projectors when needed.

It is also possible to secure substantial support from the local board of education, the chamber of commerce, the manufacturers' association and other groups with community betterment as their objective. The majority of urban communities has an adult education program and budget. It is reasonable to consider the film council as a legitimate activity of this program, and consequently there could be an allocation of funds for its support. On the other hand, there will be no large expenses in conducting a council and therefore the members can well afford to assume full financial responsibility. In this way they will be free from obligations to any person or persons that may restrict their activity.

Programs for Meeting

Every council meeting should be well planned to maintain interest at a high pitch and guarantee large attendance at subsequent sessions. The topics for discussion should cover the wide range of interests represented by the membership. Usually these are subjects

of national or world-wide importance that should be given consideration; for example, "Juvenile Delinquency," "Highway Safety," "National Merchant Marine," "Airways," "Democracy Here and Abroad." Topics of this kind have more or less of a universal appeal and may serve as the basis of a film forum.

There are hundreds of interesting films of specialized character which have not only a specific interest for a limited number of the council membership but also general interest for the majority of the members. In this category may be placed such films as, "Mining of Coal," "Fisheries of the Northwest Coast," "The Canning Industry," "The Manufacture of a Modern Motor Car," "The Flora of the Tropics," "The Story of the Airplane," "The Production of Gasoline."

It is most desirable to have a discussion leader at each film presentation, preferably one who has some interest in and knowledge of the subject presented. He should be able to supplement the film with additional factual information as well as to answer questions posed by the audience.

Some meetings should be devoted to the presentation of new films, publications on audio-visual aids, and bibliographies of available films. Other times the best techniques for showing films and the latest projection equipment should be discussed and demonstrated. If possible, topics of this kind should be presented by specialists from their respective fields of interest.

It must be constantly kept in mind that the film council was organized for local civic advantage. Consequently all discussion that takes place at the council meetings should be focused on how the organizations represented can make more effective use of audio-visual aids.

If your community does not already have a film council, ask various group leaders to join a movement for the organization of one. It is unquestionable that film is destined to play a very important role in all future education, in the formation of attitudes to all civic, moral, and religious problems and national and international understanding.

REFERENCES

Magazine Articles

1. La Follette, Robert, "Film Forum Techniques," *See and Hear*, February 1948.

2. Johnson, Rex M., "A Film Council in Action," *Educational Screen*, March 1948, p. 122.
3. "Midvale Organizes a Community Film Council," *See and Hear*, February 1948, p. 14.
4. "How to Plan a Film Forum Series," *See and Hear*, November 1947, p. 13.

Pamphlets

HOW-TO-DO-IT SERIES

1. *How to Form a Film Council*, Glen Burch.
2. *How to Obtain and Screen Films for Community Use*, Cecile Starr.
3. *How to Conduct a Survey of Community Film Needs and Resources*, Rex M. Johnson.
4. *How to Organize a Community Film Information Center*, Charlesanna Fox.
5. *How to Organize and Conduct Community Film Workshops*, Louis Goodman.
6. *How to Conduct a Community Film Forum*, Robert H. Schacht.
7. *How to Evaluate Films for Community Use*, Robertson Sillars.
8. *How to Organize a Community Film Festival*, Virginia Beard and Harold Nissley.

The first pamphlet *How to Form a Film Council* is now available and the others are in preparation. The entire series of eight pamplets will be available for $1.00. Single pamphlets 15¢ each.
Order from:

FILM COUNCIL OF AMERICA
6 West Ontario Street
Chicago 10, Illinois

9. *A Guide to In-Service Study of Audio-Visual Aids*, William R. Fulton, Consultant in Audio-Visual Education. Dept. of Audio-Visual Education, University of Oklahoma, Norman. 30 pp. 1948. 50¢.

This pamphlet is good for study groups and contains ideas in organization, bibliography information, provocative questions and short, well planned guides to activities.

CHAPTER XIX

Research in Visual Education

Research in Film Use

Research in this field will no longer be devoted solely to determining the effectiveness of audio-visual materials since the experiences of World War II have confirmed without question their value as tools of education. It is more than probable that considerable time and effort will be directed to means of developing more effective ways of seeing and hearing. The teaching of students to see and hear efficiently is as important as learning the content to be seen and heard.

There is a need to develop better techniques in the use of visual materials. Consequently departments of educational research will attempt to develop the proper psychological approach to their uses. Teachers, at the present time, have at their disposal various teaching aids, but they fail to secure maximum educational return from them because of a lack of the proper utilization.

It is safe to predict that educators, film producers, and non-profit agencies will co-operate in this effort to produce teaching aids that will meet more fully the needs of education. The American Vocational Association already appointed a committee to compile lists of needed teaching aids in industrial education, home economics, and vocational agriculture. This group not only made a comprehensive list of teaching aids that was wanted but submitted suggestive specifications for their construction. The object was to encourage manufacturers to produce teaching materials as a part of their public relations or advertising programs and in accordance with the educators' needs and use of the materials.

The studies described in the following paragraphs are further evidence of efforts in the direction just indicated.

DO "MOTIVATION" AND "PARTICIPATION" QUESTIONS INCREASE LEARNING?[1]

I Background of the Problem

This study grew out of an interest in the contribution of two important factors which influence the teaching effectiveness of films. These two factors may be termed "motivation" and "participation."

"Motivation" refers here to the extent to which pupils are alert, interested, and trying to learn the material presented in a film.

"Participation" refers to the extent to which pupils are responding actively by practicing or rehearsing the things to be learned as the material is presented.

Why These Two Factors Were Studied

Theories of learning based on psychological and educational research underline the importance of these two factors of motivation and participation in determining how much a person will learn in any given situation.

On common sense grounds, the importance of motivation in learning is also fairly obvious: one has to make an effort in order to learn effectively. The critical importance of participation may be less readily apparent, but it is equally well supported by scientific theory and evidence in the field of human learning. The essential role of participation is crystallized in the statement that we learn only by doing, not by mere passive stimulation of our sense organs—that what we learn is determined by what we do in the learning situation.

Purpose of This Study

Obviously, there are many different techniques by which pupils may be motivated to learn material presented to them. Similarly, there is a wide variety of techniques which can be used to stimulate pupil participation during the presentation of a subject. No one study can adequately assess the importance of these factors in general terms nor investigate the effects of all of the possible ways in

[1] Report on an Exploratory Study, *Motion Picture Research Project*, Yale University, New Haven, Connecticut.

which they can be manipulated. As a preliminary attack, the present study investigated the contribution of two specific procedures:

1. A procedure which attempted to increase pupils' motivation to learn specific material in a film by the use of questions designed to arouse curiosity concerning the facts about to be presented; and
2. A procedure which required pupils to participate more actively during the film showing by answering questions about various points just after they were presented.

The specific procedures used are described below. It is to be emphasized that the results of this study measure only the added contribution to learning produced by specific procedures of the type employed. Obviously, some degree of participation and motivation is already present in viewing a film in any classroom situation. Thus, the present results are in no sense to be construed as representing an over-all assessment of the importance of "motivation" or "participation" as general factors in learning.

II How the Study Was Done

Subject Matter of the Film

In order to avoid having to shoot new film footage a subject was selected for experimentation on which film material was already available. The subject chosen was "The Heart and Circulation of the Blood," a widely taught topic encompassing a considerable variety of factual material. Pictorial material from two already existing films was organized into a series of seven units or "blocks" of material, with titles such as "Structure of the Heart," "Heart Valves," "Sound of Heart Beat," and "Pulmonary Circulation," with accompanying voice-over narration.

Experimental Film Materials

Four different versions of the film were prepared, each giving exactly the same factual presentation, with identical pictorial materials and accompanying commentary. In some versions, the units were preceded by titles giving "motivating" questions and in other versions the units were followed by titles directing pupils to answer

"participation" questions. The use of these "motivating" and "participation" questions is described below.

"MOTIVATING" QUESTIONS: These were questions given on titles spliced into the film just before each unit of factual material. The questions were designed to interest the pupils in learning the material about to be presented and to direct attention to the relevant aspects of what was to be shown. For example, just before the mechanism of the audible heart beat was explained, the question was asked, "Do you know exactly what parts of your heart make the sounds which the doctor hears in the stethoscope?"

"PARTICIPATION" QUESTIONS: These questions were designed to get the pupils to respond actively by answering, at the end of each unit, a question concerning the material that had just been presented. The questions were printed on a worksheet which the pupils used during the film showing. As each unit was completed, a film title directed the pupils to answer the question covering that unit. After a short interval the correct answer was then given on the screen. For example, after showing the relation of the pulmonary circulation to the action of the heart, the film directed the pupils to answer the question, "Which chamber of the heart pumps blood to the lungs?"

The contribution of these two kinds of questions in improving the film's effectiveness was studied by comparing the amounts learned by four matched groups of pupils, when each group was shown a different version of the film. The four versions were as follows:

Version I, shown to the first group: This was a straight, factual presentation, with neither the "motivating" nor the "participation" questions.

Each of the other three versions used a factual presentation identical with that in Version I, but included in addition one or both of the two types of questions described above:

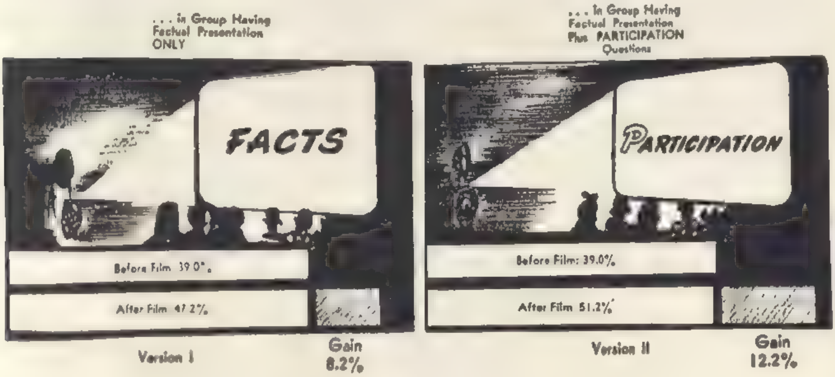
Version II, shown to the second group: The factual presentation supplemented by "participation" questions answered by the pupils after each unit of material.

Version III, shown to the third group. The factual presentation supplemented by "motivating" questions preceding each unit of the material.

Version IV, shown to the fourth group. The factual presentation supplemented by both kinds of questions, "motivating" questions preceding each unit of material and "participation" questions following each unit.

Measuring the Effect of the Film

The basic procedure used to determine the relative effectiveness of the four versions was the method of controlled experimental measurement outlined in the preceding article "The Improvement of Teaching Films." Approximately 150 tenth- and eleventh-grade pupils in public schools in the vicinity of New Haven, Connecticut, were used for each of the four versions described above. Students were assigned to the various versions in such a way as to have the group for each version balanced with the other groups with respect



to grade, level, initial test score (before the film), general ability, sex, and other factors.

A factual test was developed to measure pupils' knowledge of the subject matter covered by the film. The test was composed of forty multiple-choice questions.

All pupils were tested twice. The first test was given a week before the film showing in order to determine how much the students already knew about the subject. The second test was given just after the film in order to determine how much they had learned from seeing the film. The amount of material learned from each version of the film is, therefore, revealed by the difference between the "before" and "after" test scores for each version.* The relative effec-

* Measurements were also made for a "control group" which was tested and then re-tested after the same interval as the other groups but which was not shown the film. The average score for this group was the same (39.5%) on the first test as on the second test, showing that any gain in test scores for the other groups must be attributed to the effects of the film.

tiveness of any two versions of the film can then be seen by comparing the gain made by a group that saw one version as against the gain made by another group that saw a different version.

III Results

1. Contribution of the Procedure Used to Increase Participation (Comparison of Versions I and II)

The addition of participation questions following each block of the factual presentation resulted in a significant improvement in the amount of learning produced by the film.

This is seen in Graph 1 which compares the average test scores for the group of pupils that saw Version I, the factual presentation only (at the left), and for the group that saw Version II, presentation including participation questions (at the right). The length of the bars represents the average per cent of test questions correctly answered before the film (upper bars) and after the film (lower bars). The initial comparability of the two groups is illustrated by the fact that the two top bars (scores before seeing film) are equal.

The amount learned by each group is thus indicated by the shaded portions of the bars, which show the increases in average per cent of correct answers after seeing the film. (See also Graph 2.)

The results charted are "average" results. Thus, the values are averages for all individuals in each experimental group, and they are also averages for all 40 test questions used to test knowledge of the subject matter. Naturally some individuals learned more and others less than the average. Similarly, the percentages learning various items of information varied from item to item, and the average superiority of the participation procedure was not manifested equally on all test questions but varied from question to question.

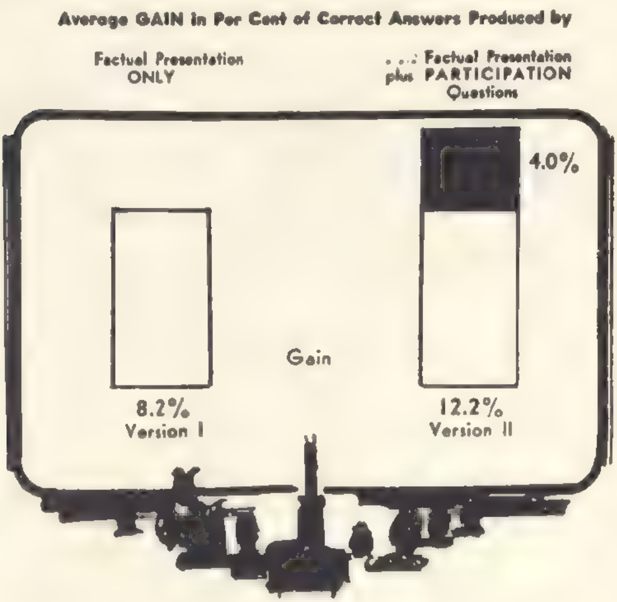
Very marked superiority of the participation procedure is illustrated by a test question on how stimulation of the vagus nerve affects the rate of heart beat. On this question, the gain in per cent of correct answers in the participation group was 47% (from 19% before the film to 66% after the film). But in the group that saw the standard presentation the gain was only 10% (from 11% to 21%).

Equal gains for both versions are illustrated by another question (normal rate of heart beat). The gains on this question were 28% for one version and 29% for the other.

2. Effect of Adding the "Motivating" Questions (Comparison of Versions I and III)

A comparison between Versions I and III deals with the contribution of the questions, designed to increase the pupils' level of motivation, which preceded each block of factual material.

The gain in average per cent of correct answers for Version III



employing factual presentation plus motivating questions, was 10.5% (from 38.8% before the film to 49.3% after the film). Graph 3 shows the comparison between this gain and that effected by the factual presentation alone.

It is seen that the higher average gain was for groups that saw the version in which "motivating" questions were included. The small size of the difference between the two versions (2.3%) does not, of course, imply that motivation is unimportant as a general factor in learning. This is particularly apparent in view of the likelihood that in all versions the pupils probably had considerable incentive to do well due to the general nature of the testing situation. The results do mean, however, that the further addition of this par-

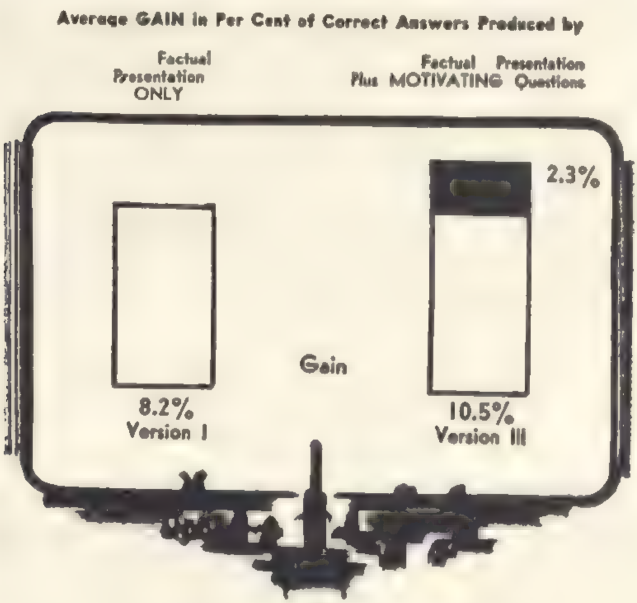
ticular kind of motivating device made at best a limited contribution to the effectiveness of the film.*

3. Further Results

A. Combined Effect of Participation plus "Motivating" Questions

The evidence in the preceding two sections shows that an improvement in learning was made by the procedure for increasing participation and also suggests that the insertion of "motivating" questions probably increased somewhat the amount learned.

The question naturally arises as to the effect of introducing both

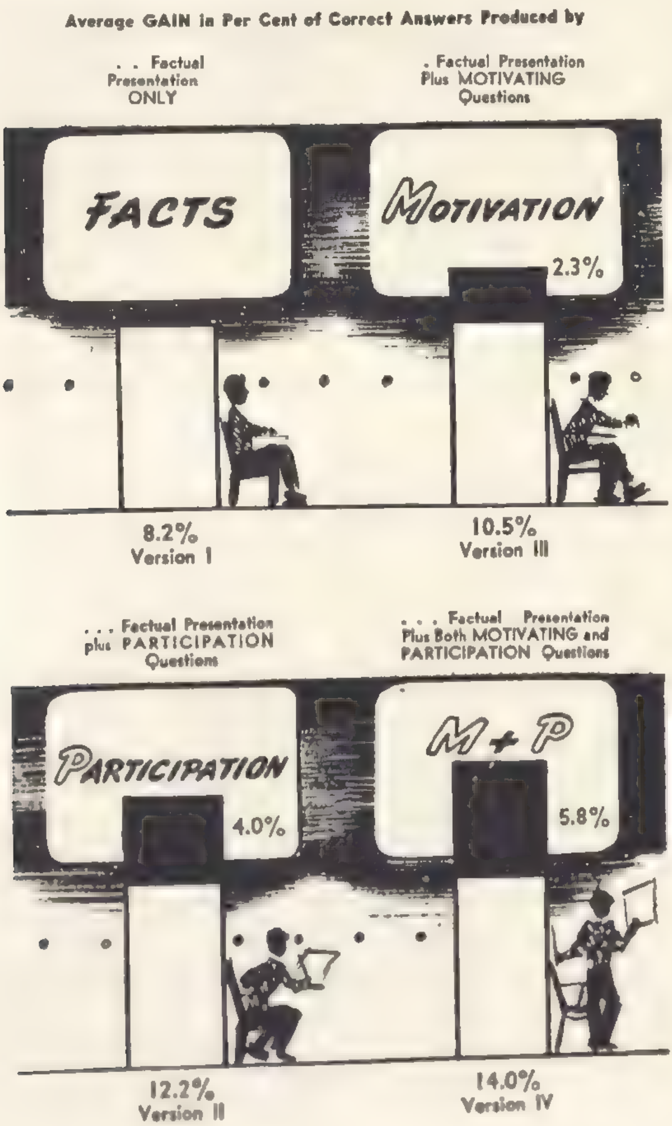


---

* It must also be remembered that all measurements of this kind are subject to a certain amount of chance fluctuation. This in turn means that, even if the "motivating" procedure had actually been completely ineffective, we would still expect in the course of a series of repetitions of the experiment to obtain slight differences in favor of the "motivation" group about half of the time. On the other hand, fairly large differences—of the size obtained through the use of the participation procedure, for instance—would occur so infrequently by chance that we may confidently conclude that the participation procedure really made a significant contribution. But less confidence is justified in the conclusion that the addition of the Version III procedure (motivating questions) made any contribution. Thus, it can be shown that if there were in fact no advantage at all in the use of the motivating questions, differences as large as the obtained one of 2.3% would occur about once in 20 repetitions of the experiment, with similar groups, simply as the result of chance fluctuations.

procedures into a film. In Graph 4, the results obtained when this is done (Version IV) are compared with those for the versions using each of the procedures singly. Two questions arise:

(1) How much did the further addition of the "motivating" questions contribute to the effectiveness of the version that already incorporated participation questions?



The answer is seen in Graph 4 by the difference between the third and fourth bars (Version II vs. Version IV). The difference in this case is only 1.8—a difference too small to be regarded as fully reliable for the samples studied. Thus again the evidence suggests, but does not conclusively establish, that adding the "motivating" questions increased the average effectiveness of the film—a conclusion which is the same whether the "motivating" questions are added to just the basic presentation already augmented by participation.

(2) How much did the further addition of participation contribute to the effectiveness of the version that already incorporated "motivation" questions? The answer here is given in Graph 4 by the difference of 3.5 between the length of the second bar (Version III) and that of the fourth bar (Version IV), and indicates that the further addition of participation significantly increased effectiveness, just as was found when the participation questions were added to the basic factual presentation alone.

The question arises as to how the increase in effectiveness due to the increased participation should be assessed. Was its contribution, for instance, worth the additional amount of time required for the use of the participation questions? A complete answer to this question calls for a comparison of the contribution made by the participation procedure with the effects that could have been achieved by spending the time in other ways. No exhaustive study of this kind was made in the present investigation. However, a comparison that is relevant is afforded by the results of one additional group of pupils who were given a double showing of the film. This comparison is presented below.

B. Comparison of Group II (Participation) and Group V (Double Showing)

The additional group of pupils (Group V) was tested to find out how much was learned by showing the basic film presentation twice (without the addition of "motivating" or participation questions). The time required for this double showing was about 17 minutes as compared with about 13 minutes for the single showing with the participation procedure.

Comparative results of the single showing of the factual material (Group I), the double showing (Group V), and the single-showing-plus participation (Group II) are shown in Table I.

TABLE I

Instruction	Approximate Time Required	Average Gain in % of Correct Answers
GROUP I—Single showing of factual material	8.5 min.	8.2%
GROUP V—Factual material shown twice	17 min.	12.0%
GROUP II—Single-showing-plus-participation-questions	13 min.	12.2%

It is seen that the single showing with participation procedure (Group II) and the double showing without participation procedure (Group V) were about equally effective although the latter required considerably more time. (Either of these methods, of course, was considerably more effective than just the single showing of the factual material alone.)

These results help to afford a base of comparison for evaluating the worth of the participation procedure. Also, they point to the need for further study both of the use of devices to increase participation in learning from films and of the effects of repeated film showings in increasing learning.

C. What Material Was Affected by Participation Questions?

An important question arising in connection with such devices as the use of "participation" questions in films is: What is the factual content that is favorably affected by the inclusion of the questions? An important possibility is that while the answering of a question about a particular point will help in the learning and remembering of that one point, it may produce distraction that results in decreasing the extent to which other points are learned.

To throw some light on this problem in the case of the present study, the gains in percentage of correct answers were analyzed separately for those test questions that were directly "covered" by the participation questions. These results were then compared with the gains on test questions that were not "covered."

The results on the two sets of questions are shown in Table II for the standard version and the "participation version" of the film.

TABLE II

Average Gains in Per Cent of Correct Answers for Two Sets of Test Questions

	Coverage by Participation Questions in Version II	
	Test Questions that WERE "Covered"	Test Questions NOT Previously "Covered"
Version II: WITH PARTICIPATION PROCEDURE	17.8%	9.0%
Version I: FACTUAL PRESENTATION ONLY	10.5%	7.8%
Difference	7.3%	1.2%

As we might expect, the major gain from including the participation procedure was on the test items quite directly covered by the participation questions. (This gain is shown by the difference of 7.3% at the left.)

For the average test item not specifically covered by participation questions, neither a loss nor an appreciable gain was found. (The average difference of 1.2% for these items is too small to give reliable evidence of any differential effectiveness for the two procedures.)

4. Some Possible Implications of the Results

A. *Implications for Film Producers*

The results of this study show clearly that even the relatively crude procedure used for increasing pupil-participation can materially increase effectiveness of an educational film. The results also suggest that the insertion of orienting or "motivating" questions pre-

ceding the presentation of factual material may contribute to the learning of that material. This means that as a tentative guide pending further investigation, film producers may well consider making increased use of such devices in attempting to increase the effectiveness of factual presentation in films.

In the case of the study reported here, "participation" and "motivation" sections were simply spliced into existing film material. With film scripts specifically designed to permit integration of these devices with factual presentation, it is quite likely that the devices contribute appreciably more than was shown in the present instances.

B. Implications for Users of Existing Educational Films

The results of the study—particularly those bearing on effectiveness of participation questions—suggest that teachers may use existing films to a greater advantage by interspersing such questions between sections of a film. The results obtained with the additional group to whom the film was shown twice also help to document the advantage that can be produced by the frequently used practice of showing a film more than once. However, the way in which this may be most effectively done remains a problem for further investigation, particularly since in the present study double showing of the factual material alone was found to be more effective than a single showing supplemented by the participation questions.

Conclusion

The example of research presented above is typical of many succeeding attempts to determine the effectiveness of a wide variety of teaching aids. At present it is safe to assume that visual teaching materials should be used because they aid teachers to present their subject matter with greater ease and appeal and thereby attract and hold the attention and interest of the learners.

References

Carpenter, C. R., "A Challenge for Research," *Educational Screen*, March 1948, p. 119.

Elliot, Godfrey, "Putting 'Participation' Into a Film," *Educational Screen*, February 1947, p. 84.

Barnes, Walter, "Responsibility of a Producer in Universal Film Production," *Audio-Visual Guide*, November 1948, p. 20.

Reese, Dan, "What's Wrong with our Films," *Audio-Visual Guide*, November 1948, p. 22.

Wimmer, Merle I., Guiding Principles in Production and Utilization of Education Films," *See and Hear*, November 1948, p. 12.

Index